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ABSTRACT

The purpose of this curriculum guide is to help teachers implement the Alabama Course of Study: Science. The major emphasis of the guide is to provide student-oriented, hands-on activities that engage students in "sciencing" behaviors. This guide has two major components, the table of contents and the activities. The table of contents lists by Roman numeral the units covered in grade 3. Each unit is organized into topics that describe further the content of the grade level. The smallest organizers in the table of contents are the student outcomes that describe in detail what students are expected to learn about each topic. After each outcome, the reader is directed by page number to a classroom activity (or activities) that addresses the specific outcome. The second and largest component of the guide consists of classroom activities. Each activity begins with identifiers that summarize and introduce the activities. The identifiers are the Unit, Topic, and Outcome(s) addressed by the activity. Each activity contains a background section that provides teachers with information they may need to teach the activity effectively. Following the background, all materials needed for the activity are listed in a section entitled "Materials." Procedures for implementing the activity are outlined next. In some cases, extensions of an activity or source for an activity appear after the section on procedures. Units include the following: (1) "Animals"; (2) "Plants"; (3) "Fungi"; (4) "Microorganisms"; (5) "Solar System"; (6) "Resources of the Earth"; (7) "Machines"; (8) "Matter and Energy"; (9) "Sound"; and (10) "Contributions and Careers in Science." (KR)

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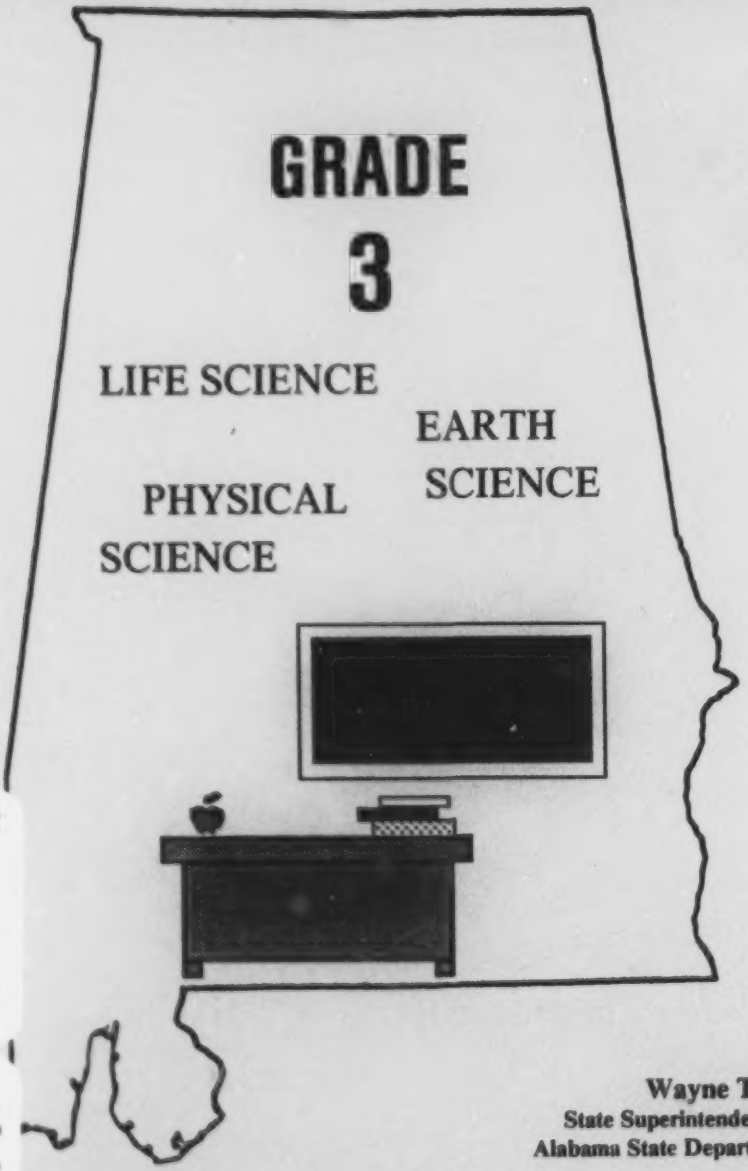

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Alabama State Department of Education

Bulletin 1989, No. 73

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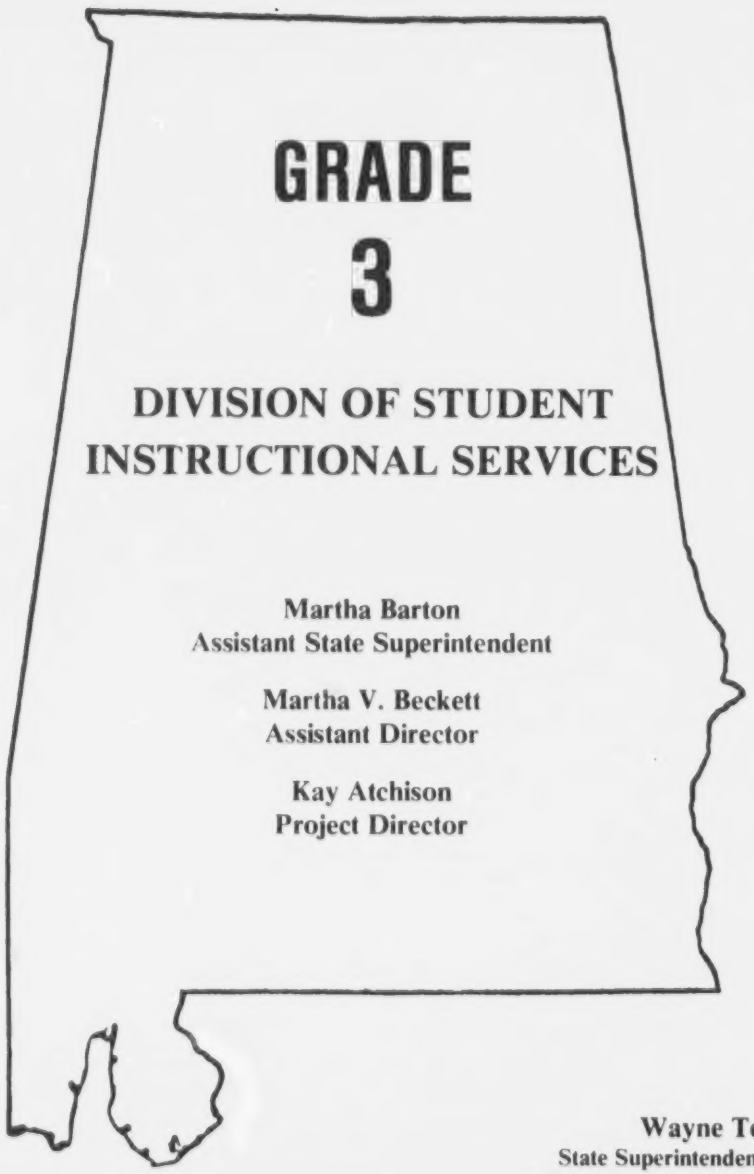


GRADE 3

DIVISION OF STUDENT INSTRUCTIONAL SERVICES

Martha Barton
Assistant State Superintendent

Martha V. Beckett
Assistant Director

Kay Atchison
Project Director

Wayne Teague
State Superintendent of Education
Alabama State Department of Education

Bulletin 1989, No. 73

INTRODUCTION

The science curriculum guides consist of nine documents, one for each grade kindergarten through grade eight. The purpose of these curriculum guides is to help classroom teachers implement the Alabama Course of Study: Science (Bulletin 1988, No. 35). The major emphasis of each guide is to provide student-oriented, hands-on activities that engage students in "sciencing" behaviors.

The science curriculum guides have two major components, the Table of Contents and the activities. Each guide begins with the Table of Contents that lists by Roman numerals the units covered at a grade level. Each unit is organized into topics that describe further the content of the grade level. The smallest organizers in the Table of Contents are the student outcomes that describe in detail what students are expected to learn about each topic. After each outcome, a page number(s) directs the reader to a classroom activity (or activities) that addresses the specific outcome.

The second and largest component of the guide consists of classroom activities. Each activity begins with identifiers that summarize and introduce the activities. These identifiers are the Unit, the Topic, and the Outcome(s) addressed by the activity. Each activity contains a Background that provides teachers with information they may need to teach the activity effectively. Following the Background, all materials needed for the activity are listed in a section entitled Materials. Procedures for implementing the activity are outlined next. In some cases, extensions of an activity or sources for an activity appear after the Procedures.

The science curriculum guides are supplemental in nature. They were created to complement and enrich locally developed science curriculum plans and to provide instructional resources for all topics named in the Alabama Course of Study: Science. Consequently, each activity in the curriculum guide stands alone and does not need to be taught in the order in which it appears in the document. It is expected that local education agencies will sequence the activities in this guide to correspond with the order in which topics are outlined in their locally developed scope and sequence for science.

ACKNOWLEDGEMENTS

From its inception, the development of curriculum guides has been viewed as a cooperative effort between specialists in the Division of Student Instructional Services and selected teachers from public schools in Alabama. While the Curriculum Development Section, under the leadership of Katherine Mitchell, had the responsibility for coordinating the project, approximately 75 educators contributed directly to the science curriculum guides.

Work on the science curriculum guides started in the fall of 1988 when Kay Atchison was selected as Project Director for grades K-6 and Donna Bentley was named Project Director for grades 7 and 8. The second phase of the project involved the recruitment and training of approximately 35 classroom teachers and university instructors who wrote activities for the guides. For six months (December 1988 through May 1989) writers created activities to address specific outcomes, and the State Department of Education staff typed, edited, and proofread numerous drafts of the activities.

The contributions of persons and institutions listed below are greatly appreciated.

WRITERS:

Margaret Allen
Montgomery County Schools

Leigh Ann Clements
Midfield City Schools

Cindy Garner
Tuscaloosa City Schools

Kathy Payne
Midfield City Schools

Pamela Rabren
Andalusia City Schools

Helen Stephens
Birmingham City Schools

Mary Tate-Hammon
Birmingham City Schools

Patricia Watkins
Hoover City Schools

PROJECT CONSULTANT:

Dale Rice
Auburn University

ACKNOWLEDGEMENTS
(Continued)

ARTIST: Nadine Harper
Montgomery, Alabama

COOPERATING ADMINISTRATORS: Louie Fryer
Andalusia Middle School

Betty LeGrone
Tuscaloosa City Board of Education

Cecil Teague
Midfield City Board of Education

Joel Roberts
Midfield City Elementary School

The contributions of the State Department of Education staff listed below are greatly appreciated.

SCIENCE SPECIALISTS: Kay Atchison
Suzan Dunn

OUTSIDE CONTENT REVIEWER: Donna Bentley

EDITORS/ PROOFREADERS: Barbara Boland
Cynthia Brown
Mary Jane Herring
Nell Kilpatrick
Deborah Thomas
Fred Wells

CHARACTER EDUCATION/ CAREER EDUCATION REVIEWER: Frances Manning

TYPIST: Rosie Brisbon

GRAPHIC ARTIST: Lisa Smith

GRADE 3
TABLE OF CONTENTS

PAGE

I. ANIMALS

Topic: Classification of Animals

Outcome 1 - Identify meat-eating animals and plant-eating animals.....7
Outcome 2 - Classify animals as mammals, reptiles, amphibians, birds, or fish.....9

Topic: Adaptation and Survival of Animals

Outcome 3 - Identify animals that migrate, hibernate, change colors, or grow heavier coats due to seasonal changes.....17
Outcome 4 - Explore causes of extinction of animals and plants.....26

Topic: Interdependence of Plants and Animals

Outcome 5 - Determine that living organisms are dependent on green plants...29

Topic: Evidence of Prehistoric Existence

Outcome 6 - Identify an extinct animal.....32

Topic: Changes Over Time

Outcome 7 - Explain how fossils provide clues about animals and plants that lived in prehistoric times.....35

Topic: Food Gathering Habits

Outcome 8 - Discover ways animals gather and store food.....38

Topic: Relation of Body Parts to Specific Function

Outcome 9 - Relate body parts of animals to specific functions.....39

GRADE 3
TABLE OF CONTENTS
(Continued)

PAGE

II. PLANTS

Topic: Classification of Plants

Outcome 10 - Identify plants by their major characteristics.....41
Outcome 11 - Identify plants according to where they store food.....43

Topic: Adaptation to Environment

Outcome 12 - Investigate ways by which plants adapt to their environments.....45

Topic: Essential Needs for Growth

Outcome 13 - Demonstrate and observe that a green plant needs carbon dioxide, water, and energy from the sun to make its food...48

Topic: Edible Parts

Outcome 14 - Explore uses of plants: food, fuel, and textiles.....52

III. FUNGI

Topic: Mushrooms

Outcome 15 - Identify parts of a mushroom.....54
Outcome 16 - Compare a mushroom to a green plant.....56

Topic: Helpful and Harmful Uses

Outcome 17 - Explore uses of yeasts, molds, and mushrooms.....59
Outcome 18 - Explore harmful effects of fungi.....61

IV. MICROORGANISMS

Topic: Protozoa

Outcome 19 - Identify three protozoans.....64

GRADE 3
TABLE OF CONTENTS
(Continued)

PAGE

Topic: Bacteria and Viruses

Outcome 20 - Discuss diseases caused by viruses and bacteria.....68

V. SOLAR SYSTEM

Topic: Composition

Outcome 21 - Identify planets and their positions in the solar system...71, 74

Topic: Planetary Movements

Outcome 22 - Demonstrate the nine planets orbiting the sun.....78

Topic: Rotation and Revolution of Earth and Moon

Outcome 23 - Demonstrate causes of day and night.....80
Outcome 24 - Demonstrate how the earth's axis and orbit are related to seasonal changes.....85
Outcome 25 - Describe movements and phases of the moon.....87

Topic: Rising of the Sun

Outcome 26 - Recognize that the sun appears to rise in the east and set in the west.....91

IV. RESOURCES OF THE EARTH

Topic: Surface Changes

Outcome 27 - Observe and discuss changes in the surface of the earth caused by wind, water, and volcanoes.....93

Topic: Composition of the Earth

Outcome 28 - Identify the composition of the earth.....104

GRADE 3
TABLE OF CONTENTS
(Continued)

PAGE

Topic: Characteristics of Rocks

Outcome 29 - Classify rocks according to weight, color, smoothness, hardness, or formation.....107

Topic: Formation of Rocks

Outcome 30 - Recognize that heat, cold, running water, plants, and people help to break rocks into pieces.....110

Topic: Composition of Soil

Outcome 31 - Identify particles found in a sample of soil.....113

Topic: Uses of Soil

Outcome 32 - Discuss uses of soil.....116

Topic: Conservation of soil

Outcome 33 - Explore ways to conserve soil....118

VII. MACHINES

Topic: Simple Machines

Outcome 34 - Identify machines that help make work easier.....124

Outcome 35 - Identify six simple machines: levers, pulleys, wedges, screws, inclined planes, and wheels.....127

Topic: Complex Machines

Outcome 36 - Identify simple machines that compose complex machines.....129

Topic: Friction

Outcome 37 - Discover that friction makes work more difficult and also causes heat.....132

GRADE 3
TABLE OF CONTENTS
(Continued)

PAGE

VII. MATTER AND ENERGY

Topic: Reduction of Friction

Outcome 38 - Demonstrate how lubrication will reduce friction.....134

Topic: Properties and States of Matter

Outcome 39 - Discover that matter takes up space and has weight.....137
Outcome 40 - Recognize that matter exists in four states: solids, liquids gases, and plasma.....137
Outcome 41 - Identify solids, liquids, or gases in the environment.....142

Topic: Physical Changes

Outcome 42 - Determine that a change of state or appearance is a physical change.....145

Topic: Effects of Temperature

Outcome 43 - Demonstrate how heat causes some matter to dissolve, melt, or evaporate.....151
Outcome 44 - Predict effects of high temperature on various objects.....154

Topic: Chemical Changes

Outcome 45 - Demonstrate simple chemical changes.....161

Topic: Conservation of Matter

Outcome 46 - Explore methods of conserving different forms of matter.....163

VIII. SOUND

Topic: Production of Sound

Outcome 47 - Identify and classify ways of producing sound.....165

GRADE 3
TABLE OF CONTENTS
(Continued)

PAGE

Topic: Vibration of Sound

Outcome 48 - Listen and distinguish among soft, high, and low sounds.....165

Topic: Sound Transmitters

Outcome 49 - Determine what forms of matter transmit sound best.....168

IX. CONTRIBUTIONS AND CAREERS IN SCIENCE

Topic: Contributions of Scientists

Outcome 50 - Identify men and women who have contributed to the fields of Life Science, Earth Science, and Physical Science.....172

Outcome 51 - Describe what men and women have done in the fields of Life Science, Earth Science, and Physical Science.....172

Outcome 52 - Explain why an understanding of Life Sciences, Earth Sciences and Physical Sciences can contribute to the quality of life in today's and tomorrow's society.....172

Topic: Career Opportunities

Outcome 53 - Identify careers related to an understanding of Life Scienses Earth Sciences, and Physical Sciences.....172

Outcome 54 - Explain how careers depend on a basic understanding of the Life Sciences, Earth Sciences, Physical Sciences.....172

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Classification of Animals
OUTCOME: 1. Identify meat-eating and plant-eating animals.

Background

Classification of animals includes the types of foods they eat. Animals that eat plants are called herbivores. Animals that eat meat are called carnivores. Animals that eat both plants and meat are called omnivores. Herbivores are plant-eating animals such as cattle, deer, and horses. Carnivores are flesh-eating animals such as weasels, lions, tigers, dogs, raccoons, seals, and walruses. Omnivores, animals that eat both plants and flesh, include brown rats, bears, badgers, oppossoms, and humans.

Materials

- Pictures of animals
- Shoe boxes (2)

Procedures

1. Discuss food-gathering characteristics of herbivores and carnivores. Give examples of animals in each category.

2. Divide the chalkboard into two parts. Label one part HERBIVORES and the other part CARNIVORES.

3. Place a shoe box on the floor under each of the two headings.

4. Divide the class into two teams.

5. Place the animals' pictures in a central location.

6. Explain "Herbivore and Carnivore Relay" rules to the students.

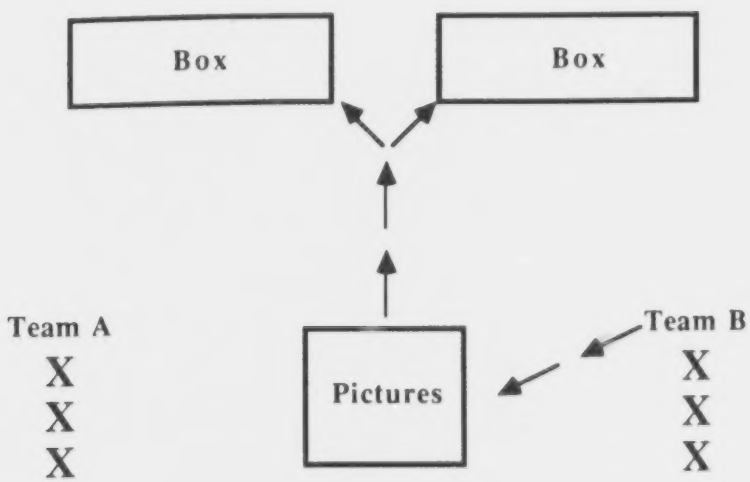
    a. Each team forms a line.
    b. On an alternating basis, one member from each team selects an animal picture from a stack of pictures.
    c. The team member choosing an animal picture must classify it as herbivore or carnivore and place it in the appropriate shoe box. Students should give evidence supporting their decisions. Such evidence would be that the animal has sharp claws and teeth for tearing and chewing, and is, therefore, a carnivore.

OUTCOME 1 (Continued)

Procedures (Continued)

d. If the team member makes a correct identification, that team wins one point.
e. If an incorrect identification is made, that team does not receive a point.
f. After all animal pictures have been chosen and classified, the team with the most points wins the game.

Herbivores	Carnivores	Score
- plant eating	- meat eating	Team A: 𝍸 | Team B: ||||



GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Classification of Animals
OUTCOME: 2. Classify animals as mammals, reptiles, amphibians, birds, or fish.

Background

Animals are classified according to certain characteristics. The classifications are mammals, reptiles, amphibians, birds, and fish. These five classifications of animals need to be discussed before this activity begins. Use the chart ANIMAL CLASSIFICATIONS to aid in this discussion.

Materials

- Chart: ANIMAL CLASSIFICATIONS

For each student:
- Resource books
- Old magazines (science)
- Scissors
- Glue
- Pencils
- Game card sheets, A through E (5)

Procedures

A. Making Animal Cards

1. Give each student five different animal game card sheets.

2. Allow students to use resource books to find examples of each classification of animals.

3. Instruct students to cut out animal pictures from magazines or draw pictures of animals and glue them on their animal cards.

4. Tell students to cut out all ten of the animal cards from their game card sheets. NOTE: Cards may be laminated for durability.

5. Have students keep their playing cards at their desks until further instructions are given.

B. Playing Animal "Concentration"

1. Divide the class into groups of four. Assign a specific area of the classroom to each group.

OUTCOME 2 (Continued)

Procedures (Continued)

2. Tell students to take all ten cards to their assigned play areas.

3. Appoint a card dealer for each group.

4. Instruct the dealer to shuffle all cards (40 cards).

5. Instruct the dealer to place the cards in four rows of ten.

6. Explain the game rules to the students.

   a. Each player takes one turn.

   b. The first player turns two cards face up.

   c. If the cards match by classification, the player takes the pair.

   d. If the cards do not match, the player returns them to the deck face down.

   e. Other players then take turns.

   f. The game continues until all pairs are matched.

   g. The player with the most paired cards at the end of the game is the winner.

7. Instruct the students to play the game.

8. Repeat the game for comprehension, if necessary.

ANIMAL CLASSIFICATIONS
Chart

Mammals:	Mammals have a body covering of hair. This includes all species of animals that possess mammary or milk glands for feeding their young. Mammals are warm-blooded animals.
Reptiles:	Reptiles have dry, scaly skin. They are cold-blooded, which means their body temperature stays the same as its surroundings. To stay alive, reptiles must avoid extremely high or low temperatures.
Amphibians:	Amphibians are animals with scaleless skin that live part of their lives on land and part of their lives in water. Most of them lay their eggs in or near water. They are cold-blooded.
Birds:	Birds are animals with feathers. All birds have wings. Not all birds fly, however. Ostriches walk and run, and use their wings for balance. Penguins swim, and use their wings as flippers. Birds are the fastest travelers of all animals.
Fish:	Fish live in the water. There are more kinds of fish than all other water and land vertebrates combined. Fish vary greatly in size, shape, and color. Fish use gills to breathe.

Study of Animals

Name

Mammals

Mammals

GAME CARD A

12

19

20

Study of Animals

Name

Reptiles

Reptiles

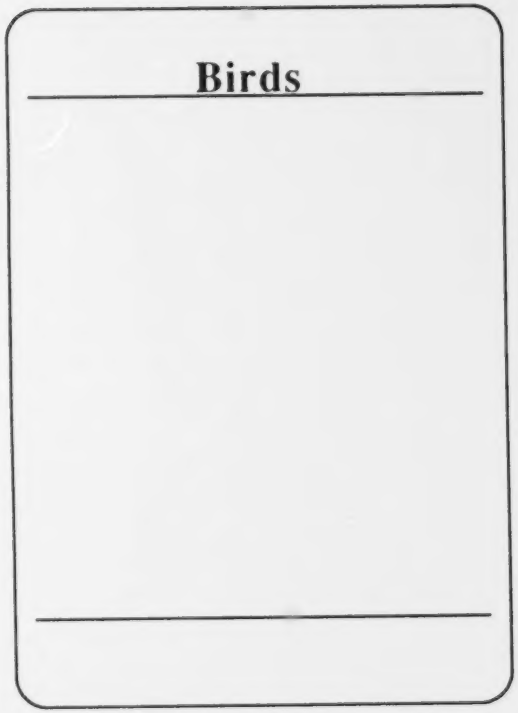
21

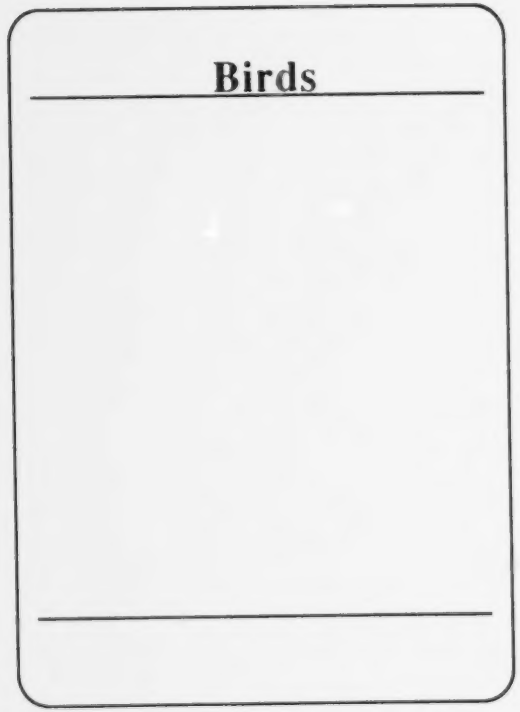
22

GAME CARD B

Study of Animals

Name





GAME CARD C

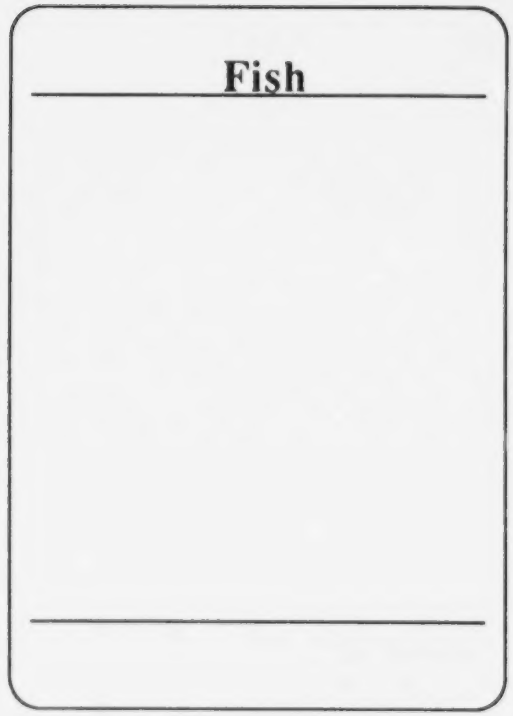
14

23

24

Study of Animals

Name



GAME CARD D

Study of Animals

Name _____

Amphibians

Amphibians

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Adaptation and Survival of Animals
OUTCOME: 3. Identify animals that migrate, hibernate, change colors, or grow heavier coats due to seasonal changes.

Background

As days grow shorter and nights grow longer, animals make necessary preparations for the cold winter months. Rabbits, bears, and birds are all examples of animals that either change colors, grow heavier coats, hibernate, and migrate due to seasonal changes.

Rabbits, dogs, cats, and other animals, grow thicker coats in preparation for the long winter months. The hair of some rabbits also changes color. The fur of the arctic rabbit becomes white to blend with the snow.

Bears, shrews, rodents, and other animals hibernate. In the winter they go into a deep sleep called hibernation. There is controversy among scientists as to whether or not bears are true hibernators. Bears are not classified as hibernators because their body temperature falls only slightly during the winter sleep. Since the bears' large bodies do not lose as much heat as the small bodies of other hibernators, their body temperature stays high during hibernation. On warm winter days, the bear may awaken and forage for food.

Many birds spend their winters in a warmer climate. As the weather turns cold, birds migrate or fly to a warmer climate.

In this activity, students use the animal patterns to portray specific verses while reciting the poem "Necessary Preparations."

The handout SEASONAL ADAPTATIONS should be prepared before the activity is introduced.

Materials

- Handout: SEASONAL ADAPTATIONS
- Poem: "Necessary Preparations"
- Resource books
- Construction paper
- Crayons
- Scissors
- Pencils

OUTCOME 3 (Continued)

Materials (Continued)

For each group:
- Cat pattern (4)
- Arctic rabbit pattern (4)
- Bear pattern (4)
- Bird pattern (4)

For each Student:
- Index cards

Procedures

Divide the class into four groups. Give each student one index card. Display the visual aid SEASONAL ADAPTATIONS that lists the four adaptations for survival. Lead a discussion about the different survival adaptations various animals use.

Part A. Preparing Index Cards

1. Tell students to copy the categories from the visual aid SEASONAL ADAPTATIONS onto their index cards.

2. Instruct students to use resource books to find examples from each category.

3. Tell students to write their examples in the appropriate spaces on their index cards.

4. Lead a discussion of the various examples.

Part B. Making Animal Patterns

1. Assign each group one of the following animals: rabbit, bear, bird, or cat.

2. Distribute the four (4) appropriate animal patterns to each group.

3. Instruct each student to color and cut out an animal pattern.

4. Tell students that their animal patterns will be used to make the poem come alive during recitation.

Part C. Reciting the Poem

1. Read the poem "Necessary Preparations" to the class.

2. Assign the poem for memorization.
   Note: The poem may be memorized in parts or as a whole.

OUTCOME 3 (Continued)

Procedures (Continued)

3. Encourage students to make their parts come alive by acting out their assigned animal verses. Have students display their animal patterns during recitation of their verses.

SEASONAL ADAPTATIONS
Handout

List as many examples as you can find for each category.

1. Migrate

2. Hibernate

3. Change color

4. Grow heavier coats

Necessary Preparations
Poem

When the weather changes and begins to feel cold,
Many animals make necessary preparations, I'm told.

An Arctic Rabbit once said, with a smile,
"This is not my permanent color or style.
In order to hide and protect me,
My colors change to those hard to see."

When the weather changes and begins to feel cold,
Many animals make necessary preparations, I'm told.

"Is that a thick new coat, Mr. Cat?"
"Why yes, in the winter I sometimes look fat.
It keeps me warm and cozy until spring comes again.
Then I shed my winter coat and look a little thin."

When the weather changes and begins to turn cold,
Many animals make necessary preparations, I'm told.

Now it's time to bid the birds farewell,
As they gather friends and family to set sail.
"Flying south we'll find the warmth of the sun,
And there we'll stay until winter is done."

When the weather changes and begins to turn cold,
Many animals make necessary preparations, I'm told.

Leigh Ann Clements

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Adaptation and Survival of Animals
OUTCOME: 4. Explore causes of extinction of animals and plants.

Background

Fossil records suggest that many plants and animals have become extinct. Scientists and other concerned groups are increasingly alarmed at the endangerment of certain species of plants and animals.

Climate and seasonal changes affect the survival of organisms. Some animals migrate to more favorable environments according to the seasons. Animals cannot survive and reproduce when their natural habitats undergo severe upheaval and destruction, or when food and water supplies are depleted or polluted. Plants also suffer from pollution and destruction of their natural environments.

Many plant and animal species are endangered today because people have not come to a full understanding of how plants and animals are dependent upon each other for survival. Students need to gain a new respect for life in its many forms. Even though some organisms must be controlled, man should not aim at total destruction of them.

A list of extinct and endangered species is provided at the end of the activity. The list is not exhausive and may have additions at the discretion of the teacher.

Materials

For each student:
- Reference books
- Pictures
- Drawing paper
- List of extinct and endangered animals

Procedures

1. Assign a research project. Use the list of extinct and endangered animals. Have each student choose a different animal from the list provided.

2. Direct students to make a report to the class when they have finished their research. In each report have students include the name of the species, the animal's habitat or location, cause or causes of extinction or endangerment, and suggestions as to how the species might be saved.

OUTCOME 4 (Continued)

Procedures (Continued)

3. Have students either draw a picture of the animal chosen for their research or make a poster with pictures and information found in reference books.

EXTINCT ANIMALS

1. Dinosaur
2. Wooly Mammouth
3. Saber-toothed tiger
4. Dodo bird
5. Carrier pigeon
6. Tepopa pupfish
7. Caribbean monk seal
8. New Zealand's flightless moa

ENDANGERED ANIMALS

1. Manatee of Florida
2. Bald eagle
3. Whales (various species)
4. Black rhinoceros
5. Panda
6. Kemp's ridley turtles
7. Black-footed ferret
8. Gorilla
9. Napal snow tiger
10. California condor
11. Peregrine falcon
12. Florida panther
13. Red wolf
14. Golden lion
15. Various insects and butterflies
16. Kite bird in Florida

(See Life Magazine, April 1989.)

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Interdependence of Plants and Animals
OUTCOME: 5. Determine that living organisms are dependent on green plants.

Background

Living organisms are dependent on green plants for their existence due to an important exchange of gases that takes place between the two. All animals require oxygen for life. Animals breathe in oxygen and exhale carbon dioxide. Plants absorb the carbon dioxide because they need it to live. Plants, then, produce oxygen that the animals need. Remind students that plants also take in oxygen and give off carbon dioxide in the process of respiration. In this way, the supply of oxygen and carbon dioxide in the air remains relatively constant. If there were no green plants to recycle carbon dioxide, soon the atmosphere would contain no oxygen and animals could no longer exist.

Living organisms are also dependent on green plants because green plants are the base of the food pyramid.

Materials

For each group:
- Plastic shoe box terrarium
- Topsoil
- Grass seed
- Small animals (chameleon-cricket)
- Water
- Cup
- Chart: TERRARIUM CHECK
- Plastic wrap

Procedures

1. Divide the class into groups of five.

2. Distribute a shoe box to each group.

3. Have students put several cups of topsoil in the bottom of the shoe box.

4. Have students plant grass seed in the shoe box.

5. Instruct the students to water the soil.

OUTCOME 5 (Continued)

Procedures (Continued)

6. When the grass sprouts, have students place several crickets in the shoe box terrarium and cover the box with plastic wrap.

7. Allow all students in the group to observe the box.

8. Place the daily terrarium check chart near the box.

9. Assign the following responsibilities to a different student in the group each day.

   a. Check plants and water soil, if necessary.
   b. Observe the crickets.
   c. Complete the appropriate area of the chart. Write any comments for that day.

NOTE: All students in each group should be allowed to observe and record comments.

TERRARIUM CHECK
Chart Key

	Name	Date	Check Plants	Check Animals	Comments
1.	John	3/26	No change	No change	
2.	Julia	3/29	Plants sprouted	No change	
3.	Jack	3/30	Plants grown	No change	Crickets have eaten some plants
4.					
5.					
6.					
7.					
8.					
9.					
10.					
11.					
12.					
13.					
14.					
15.					
16.					
17.					
18.					
19.					
20.					
21.					
22.					
23.					
24.					
25.					
26.					
27.					

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Evidence of Prehistoric Existence.
OUTCOME: 6. Identify an extinct animal.

Background

Extinction is a process that has happened since life appeared on earth. A species of an animal becomes extinct when every one of its kind has died. Most extinct animals died out because of loss of food source, destruction of habitat, or changes in environment. Humans have caused many animals to become extinct. Activities such as farming, hunting, logging, or settling by man contribute to extinctions.

An example of extinct animals is Eohippus or Hyracotherium, the earliest horse. Others are the dinosaur, the dodo, the great auk, the Labrador duck, the moa, the passenger pigeon, Stellar's sea cow, the quagga, Przewalski's horse, and the European bison.

This activity enables each student to invent and then identify an extinct animal. The animal is one the student creates based on previous understanding of extinct animals.

Materials

For each student:
- Modeling clay, various colors
- Shoe box
- Markers
- Handout: EXTINCT ANIMAL CARD

Procedures

1. Discuss various extinct animals and the causes of their extinction. Refer to information noted in the background.

2. Distribute modeling clay to students. Instruct students to create their own extinct animals.

3. Tell students to name their animals.

4. Ask students to use the shoe boxes and colored markers to make their extinct animals' habitats.

5. Distribute to each student the handout EXTINCT ANIMAL CARD. Instruct students to complete the cards and attach them to their boxes.

OUTCOME 6 (Continued)

Procedures (Continued)

6. Tell students to place their extinct animals in their shoe boxes.

7. Display the extinct animals for class viewing.

8. Allow all students to discuss the information on their EXTINCT ANIMAL CARDS.

EXTINCT ANIMAL CARD
Handout

Name of extinct animal:

Where did the animal live?

What did the animal eat?

What were the causes of extinction?

Name of Student

_____

Name of extinct animal:

Where did the animal live?

What did the animal eat?

What were the causes of extinction?

Name of Student

_____

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Changes Over Time
OUTCOME: 7. Explain that fossils provide clues about animals and plants that lived in prehistoric times.

Background

A fossil is the remains of a plant or animal that lived in the past but now lies embedded in rock. Fossils can provide information about the past history of life on Earth, including changes in climate, geography, and life forms. For instance, the imprint of a palm tree found in Greenland indicates that the climate was once warm there. Skeletal imprints can show the actual life forms that existed in the past. Finding imprints of sea creatures in the desert shows that the earth has undergone geographical changes. What was once an ocean is now a wasteland.

In this activity, students will create their own fossils. Their fossils will indicate things that are important to them. Each fossil should represent a specific characteristic that would let others know more about that person.

Materials

- Petroleum jelly
- Wax
- Bowl for wax
- Canned heat
- Jellied fuel stove

For each student:
- Modeling clay
- Paper
- Objects to make fossils
- Spoon
- Glue
- Handout: FOSSIL

Procedures

1. Instruct the students to do the following:
   a. Get a handful of modeling clay.
   b. Use the hands to work with the clay until it is very soft.
   c. Press into the clay an object that symbolizes a certain characteristic about that person.
      (Example: A fish hook for someone who likes to fish.)
   d. Remove the object form the modeling clay.

OUTCOME 7 (Continued)

Procedures (Continued)

2. Melt the wax in the bowl on a jellied fuel stove.

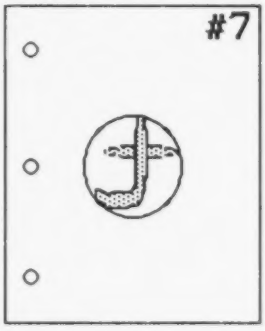
3. Ask students to spread petroleum jelly into their clay imprints.

4. Spoon melted wax into clay imprints carefully.

5. Tell students to remove the wax fossils from the clay when it cools.

6. Distribute paper, assign each student a number, and instruct students to write their numbers on the upper right hand corners of their papers.

7. Have students glue fossils onto their papers.



8. Display the fossils in the classroom.

9. Distribute the handout FOSSIL.

10. Tell students to walk around the room, observe all fossils, and complete the handout.

FOSSIL
Handout

Name: _____

Fossil #	Who made this fossil?	Why do you think so?
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		
13.		
14.		
15.		
16.		
17.		
18.		
19.		
20.		
21.		
22.		
23.		
24.		
25.		

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Food Gathering Habits
OUTCOME: 8. Discover ways animals gather and store food.

Background

All animals must have food to survive. Animals gather and store their food in many different ways. Chipmunks leave their homes to look for food. They search for seeds and nuts. They use pouches in their cheeks to carry food to their burrows.

Flowers provide food for bees. Bees collect tiny grains of pollen and nectar from blossoms. During these food-gathering flights, bees spread pollen to other flowers. This helps the flowers grow and reproduce. Bees take the nectar back to the hive to make honey. Squirrels search for berries, corn, fruits, nuts, mushrooms, and seeds. After the squirrels gather food, they hide the food in holes in the ground, in trees, or in dens.

Each kind of animal has special body features used to obtain food in its environment.

Materials

- Pictures of various animals such as chipmunks, squirrels, and bees.

Procedures

1. Divide the class into two teams.
2. On a rotating basis, allow one member from each team to come to the front of the classroom to "charade" an animal chosen from several pictures of animals.
3. Remind students to mimick the animal chosen and its method of gathering and storing food.
4. Give points to the team that first identifies the animal correctly.
5. Continue charades until all animals have been chosen.
6. Lead a closing discussion. Discuss each animals method of gathering and storing food.

GRADE 3
LIFE SCIENCE

UNIT: Animals
TOPIC: Relation of Body Parts to Specific Functions
OUTCOME: 9. Relate body parts of animals to specific functions.

Background

Animals have body parts adapted for specific tasks that help the animal survive. Animals use their bodies to get food, to bear young, and to protect themselves from their enemies. Animals can use parts of their bodies as tools. The beaver has chisel-shaped front teeth that help it cut down trees. The mole uses its large front paws as shovels to dig into the ground. The elephant uses its trunk for eating, guiding its young, fighting, lifting heavy loads, and performing other tasks.

Materials

- Chart: ANIMALS AND THEIR BODY PARTS

For each student:
- Index card, 3"X 5"

Procedures

1. Display the chart ANIMALS AND THEIR BODY PARTS.

2. On some index cards, write the names of animals. On other index cards, write the animals' corresponding body parts. Distribute cards with animal names to half of the students and cards with body parts to the remaining students.

   NOTE: The number of animals chosen should equal half the number of students in the class. If there is an odd number in the class, the teacher may need to participate.

3. Instruct students to match the animal names with their body parts by comparing cards with other students.

4. Tell students to discuss with their partners specific functions of each body part.

5. Lead a group discussion on animal body parts and their functions.

ANIMALS AND THEIR BODY PARTS
Chart

Animals	Body Parts	Specific Function
Beaver	Chisel-shaped front teeth Paddle-like tail	Cutting trees Packing mud
Mole	Large shovel-like paws	Digging holes in ground
Elephant	Trunk	Eating, guiding young, fighting
Bees	Brushes on legs	Gathering pollen
Porcupine	Quills	Protection
Kangaroo	Pouch	Carry young
Fish	Gills	Breathing
Snake	Hinged jaw	Swallowing
Cow	Tails	Swatting flies
Cat	Whiskers	Used to feel
Turtle	Shells	Protection
Bird	Wings	Flying
Ostrich	Wings	Balance
Penguin	Wings	Swimming
Duck	Webbed-feet	Swimming
Chameleon	Skin changes color	Protection
Whale	Blow hole	Breathing
Octopus	Tentacles	Grabbing food
Deer	Antlers	Protection
Mule	Hoofs	Protection
Wasp	Stingers	Poison for protection
Tarantula	Poisonous fangs	Protection

GRADE 3
LIFE SCIENCE

UNIT: Plants
TOPIC: Classification of Plants
OUTCOME: 10. Identify plants by their major characteristics.

Background

The plant kingdom is divided into two major phyla: bryophytes and tracheophytes. These phyla are commonly divided into two groups: plants that do not produce seeds, and plants that do produce seeds. Bryophytes are simple plants. They have simple leaves. They do not have true roots or stems, but they do have root-like and stem-like parts. They do not produce flowers. They reproduce by spore formation. Mosses and liverworts are bryophytes. Tracheophytes include some plants that produce seeds and others that do not produce seeds. Unlike the bryophytes, the tracheophytes do have true roots, stems, and leaves. Ferns, club mosses, and horsetails do not produce flowers, fruits, and seeds.

Seed plants are divided into angiosperms and gymnosperms. Angiosperms are seed plants that produce flowers which later form fruits with seeds inside. All garden plants, weeds, cereal grains, grasses, vegetables, trees, and shrubs that lose their leaves in autumn are angiosperms.

Gymnosperms are seed plants that produce cones. These cone-bearing plants are called conifers. Most cones are made of layers of woody scales, and their seeds lie unprotected on the scales. These plants have long needles or flat leaves. Their needles or leaves retain their green color throughout the seasons. This is why they are called evergreens.

Materials

For each student:
- Plastic cola bottle (2-liter)
- Sharp knife
- Potting soil or woods soil
- Small ferns and mosses

Procedures

A. Explain bryophytes and tracheophytes. Tell students to identify some plants that belong to each phyla. Ask the students to bring certain items from home for use on a display table. These items may include mosses, ferns, pine needles, pine cones, and foods such as pop corn, beans, apples, or oranges.

    1. Direct students to make a simple terrarium by removing the solid plastic bottom from a two-lite cola bottle.

OUTCOME 10 (Continued)

Procedures (Continued)

2. Have students fill the base with loose soil.

3. Direct the students to examine the mosses and ferns with their hands lens before placing them in the plastic base. Have students list the characteristics of the mosses and ferns. (No flowers, no stems, no true roots.)

4. Have students place the plants in the soil and water them well.

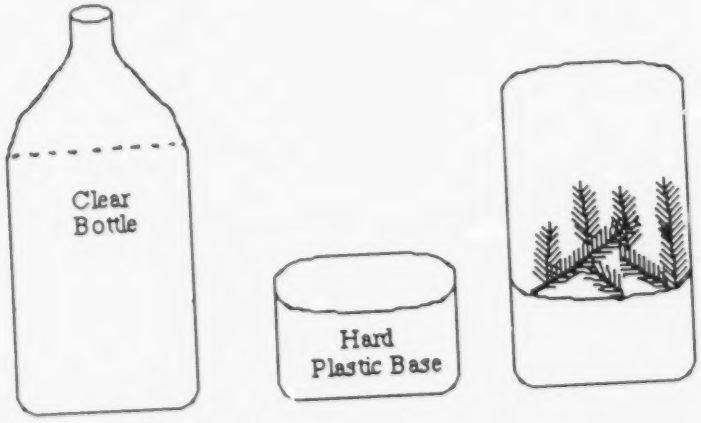
5. Cut the top off of the plastic bottle just below where the neck begins to form (see picture). Have students turn the lower half of the clear bottle upside down into the hard plastic base to cover the plants.

6. Have students discuss the major characteristics of the plants in the terrarium. Are they bryophytes or tracheophytes? (See background.)

B. Explain angiosperms and gymnosperms. Ask students to bring from home plants from these two categories. Prepare the display table with materials and foods the students bring from home.

1. Have students identify the gymnosperms and the angiosperms on the table.

2. Ask students to discuss their reasons for placing the materials in one group or the other.



GRADE 3
EARTH SCIENCE

UNIT: Plants
TOPIC: Classification of Plants
OUTCOME: 11. Identify plants according to where they store food.

Background

Angiosperms, or flowering plants, are divided into two large groups: monocotyledons or monocots, and dicotyledons or dicots. A cotyledon is a special kind of leaf found in the seed. The cotyledons contain stored food which nourishes the tiny plant (embryo) inside the seed as the seed germinates and sprouts. This nourishment continues until the new plant develops roots and leaves to provide life functions for the plant.

The monocots produce seeds that have only one seed leaf (cotyledon). Most of the monocots are small and include such plants as lilies, tulips, irises, onions, cereal grains, date palms, and coconuts.

The dicots have two seed leaves (cotyledons) in their seeds. The dicots include vegetables, flowers, flowering trees, and shrubs.

Materials

For each group:
- Sponges (2)
- Aluminum pie pans (2)
- Large lima beans (6)
- Corn seed (6)
- Water
- Hand lens
- Drawing paper

Procedures

1. Divide the class into four groups and distribute the materials to each group.

2. Have each group place large lima beans on a wet sponge in an aluminum pie pan. On a different pie pan, place the corn seeds on a wet sponge. Cover the seeds with damp paper towels. Have students place the pans in a sunny location.

3. Instruct each group to keep the sponges moist for three or four days until the beans and corn sprout.

OUTCOME 11 (Continued)

Procedures (Continued)

4. Discuss the difference between monocots and dicots. Tell the students that lima beans are dicots and corn seeds are monocots.

5. Direct students to crack the beans open to display the two seed leaves. Have students compare the beans to the corn.

6. Direct each student to draw a picture of the opened bean and the corn seed. Tell the students to describe in writing the differences between the two types of seeds.

GRADE 3
LIFE SCIENCE

UNIT: Plants
TOPIC: Adaptation to Environment
OUTCOME: 12. Investigate ways by which plants adapt to their environments.

Background

In nature, living things inhabit environments where their needs can be met most effectively. All plants and animals grow best in the climate and surroundings to which they are specially adapted.

People have learned to live almost anywhere because of their ability to adapt their surroundings to their needs. Over many, many generations plants and animals have adapted to seasonal conditions such as changes in temperature, light, and availability of food and water in their environment. This activity will investigate ways by which plants adapt to their environments.

Materials

For each student:
- Handout: PLANT ADAPTATION

Procedures

1. Share the following riddle with the students.

   I am a bird.
   I fly to a warmer climate for the winter.
   I migrate.

   Ask questions similar to the following:
   "Why did this animal make a change?" (It was the animal's way of adapting to climatic changes)."What would happen to the bird if it didn't make the changes?" (It could die.)

   Explain to students that many animals can adapt.

2. Ask, "How do you think plants adapt?" (Accept student responses.) Tell students that all plants are specially equipped to live in certain kinds of places.

3. Distribute the handout PLANT ADAPTATION and discuss it. Take students on a nature walk. (Plants not observed on the walk can be brought into the classroom for observation.)

OUTCOME 12 (Continued)

Procedures (Continued)

Extension

1. Select and observe a tree through the seasons. Have students draw pictures of the changes that occur.

2. Have students grow and observe a variety of plants in the classroom. Have students note changes and causes of changes to clarify adaptations.

PLANT ADAPTATION
Handout

Type Plant	Adaptation
Broad-leaved trees	Shed leaves to prevent water loss.
Evergreens (Conifers)	Leaves are covered with cutin which reduces water loss.
Cacti	Store water in thick stems for later use.
Some tropical trees	Armored to prevent water loss.
Bulbs	Food is stored in bulbs underground through winter. They sprout in the spring.
Various Plants	Die in fall or winter, but first sow seeds that sprout in spring season.
Plants that die down to the ground	Fallen leaves protect the plants until spring.

GRADE 3
LIFE SCIENCE

UNIT: Plants
TOPIC: Essential Needs for Growth
OUTCOME: 13. Demonstrate and observe that a green plant needs carbon dioxide, water, and energy from the sun to make its food.

Background

Sunlight helps plants make their own food. During this process, oxygen is produced and released into the air. People and animals breathe in air containing oxygen. They exhale air that carries carbon dioxide produced in the body. Plants combine the energy from sunlight with the carbon dioxide in the presence of chlorophyll to make food.
On the day prior to this activity, seeds should be placed in a large dishpan lined with paper towels. Cover the seeds with water and allow them to soak overnight.

The activity will take about two weeks to complete.

Materials

- Dishpan
- Hole punch
- Tape (3 rolls)
- Masking tape
- Measuring cup (4)
- Water
- Centimeter ruler (4)

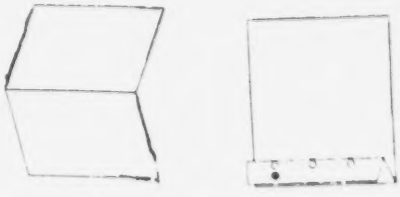
For each student:
- Seeds, lima beans work well (3)
- Paper towel
- Plastic sandwich bag with fold lock top (1)
- Handout: PLANT GROWTH RECORD SHEET

Procedures

Day One

1. Distribute one sandwich bag, three seeds, and one paper towel to each student.

2. Direct students to fold the paper towel in half, then fold half of it into half again to form a tray.



3. Instruct students to punch three holes in the bottom of the paper tray.

4. Have students place the seeds in the bottom of the paper towel tray above the holes.

OUTCOME 13 (Continued)

Procedures (Continued)

5. Instruct students to tape the sides of the paper tray closed.

6. Tell students to slide the paper tray into a sandwich bag.

7. Allow students to moisten the paper towel with a measured amount of water (1/8 cup per student).

8. Divide the class into three groups.

   Group A. Control (Seeds will get water, light, and carbon dioxide.)

   Group B. No-water (Seeds will get carbon dioxide and light.)

   Group C. No-light (Seeds will get carbon dioxide and water.)

9. Instruct students to write their names and group letters (A, B, C) on pieces of masking tape, and place on their sandwich bags.

10. Direct students in groups A and B to put their sandwich bags in a well-lit area; for example, tape them near windows.

11. Direct students in group C to put their sandwich bags in a dark area such as a closet.

Days Two-Nine

1. Distribute handout PLANT GROWTH RECORD SHEET to each student.

2. Discuss the term "hypothesis" with the class. Explain that a hypothesis is an educated guess. Give examples. Have students complete the hypothesis section on the lower left of the handout.

3. Instruct students in groups A and C to moisten the paper towels on a regular basis, every other day.

4. Help students use a centimeter ruler to measure daily growth. Have students record their measurements on their PLANT GROWTH RECORD SHEETS.

Day Ten

1. Tell students to remove the bags from designated areas.

OUTCOME 13 (Continued)

Procedures (Continued)

2. Have students complete the final illustration on the PLANT GROWTH RECORD SHEET.

3. Discuss the handout GROWTH RECORD SHEET with the class. Include the following questions:

   a. Which plant group grew the most?

   b. Which group showed little or no growth? Why?

   c. When did you observe the most growth in your plant? Why?

   d. What does a green leaf on the plant mean? What process has taken place? What causes the leaf to be green?

   e. What does it mean when the leaves are yellow?

PLANT GROWTH RECORD SHEET
Handout

Group _____ (Letter) Name _____

_____ (Name)

Days	Amount of Growth
1.	_____
2.	_____
3.	_____
4.	_____
5.	_____
6.	_____
7.	_____
8.	_____
9.	_____
10.	_____

Hypothesize what you think the plant will look like on Day 10	Draw an illustration of the plant on Day 10

GRADE 3
LIFE SCIENCE

UNIT: Plants
TOPIC: Functional Uses
OUTCOME: 14. Explore uses of plants: food, fuel, and textiles.

Background

Plants are essential to the existence of humanity. Without plants there would be no life. Food, clothing, and shelter come directly or indirectly from plants. Animals that provide food for us also eat plants. Fibers from the cotton and flax plants are made into textiles, and fibers from the hemp and sisal plants are used to make rope. Hemp is also used to make a rough, coarse cloth. Rubber is manufactured from the latex (sap) of the rubber tree. Spice and cinnamon come from the bark of the cinnamon tree, and chewing gum comes from the chicle tree. Trees have many uses. Wood is used to build furniture, houses, and other buildings. Pulp wood is used to manufacture paper and cardboard. Fruit and nut trees provide food for humans and other animals. Wood is used for fuel and in the manufacture of charcoal. (Even coal was once alive in the form of plants.)

Materials

- Display table
- Index cards, 3" x 5" (1 package)

For each group:
- Hand lens
- Poster board
- Glue or clear tape
- Labels from cans of foods and cooking oil--small packets of dry foods (beans, cereals, grains, corn meal, wheat flour, and spices)--scraps of cotton cloth and linen--short pieces of rope and string or a burlap sack--a stick of wood, a piece of charcoal, and a lump of coal.

Procedures

Explain that plants have many uses. Give examples of how plants contribute to survival. Divide the class into four groups for the poster board activity.

1. Direct students to look at the materials on the display table and divide the materials into the following categories: foods, food products, fuels, and textiles. Remind students that some plants can serve more than one purpose.

OUTCOME 14 (Continued)

Procedures (Continued)

2. Have students examine the textiles, the rope, and the string under a hand lens. Tell the students to describe what they see.

3. Have students prepare cards to identify each of the products. Keep large items on the table. Small segments may be separated or removed from the larger pieces to be placed on posters.

4. Direct students to prepare materials for posters in the following manner. Have students prepare food labels for one poster, food products such as beans and rice for another, textiles and rope (or string) for the third poster, and fuel products such as wood and charcoal for the fourth.

5. Assign each of the four groups one of the categories.

6. Have each group use the materials to prepare a poster to illustrate the assigned category.

7. Have several students write the legends for the posters on index cards. Display the posters and the legends in a prominent place.

8. Ask students to discover other uses for plants. Use questions similar to the following: What does cattle food contain? What plant is used for making maple syrup? How do we get sugar? How can corn be used as a fuel?

GRADE 3
LIFE SCIENCE

UNIT: Fungi
TOPIC: Mushrooms
OUTCOME: 15. Identify parts of a mushroom.

Background

Mushrooms are a fungi and grow in dark, damp areas. The two parts of a mushroom are the stem and the cap. Since mushrooms are fungi, they do not have seeds that grow new mushrooms. Mushrooms reproduce by spores. This two-day activity will help students observe different parts of a mushroom. NOTE: Caution should be taken with students who are allergic to fungi spores.

Materials

- Hair spray
- Pairing knife

For each student:
- Mushrooms
- Construction paper, 12"x12"
- Rubber cement
- Small paint brush
- Pencils (2)
- Small bowl
- Small bag

Procedures

Day One

1. Give each student a small bag. Take students on a field trip to locate and pick mushrooms. Caution students not to eat any mushrooms and to take special care to keep the caps and stems intact. (If no mushrooms are growing in the area, they may be purchased from the supermarket.)

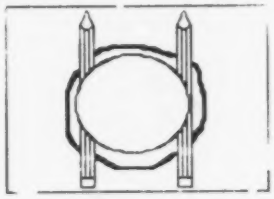
2. Have students carefully remove the stems. If the rim of the cap is covering the underside of the mushrooms, trim some away for the students so that the spores can fall out.

3. Tell each student to brush rubber cement on a piece of construction paper. (This should be completed in a circular shape a little larger than the mushroom cap.)

OUTCOME 15 (Continued)

Procedures (Continued)

4. Have students position two pencils on the paper so that the cap can be placed over them.



5. Have each student place a bowl over the cap and leave it for 24 hours.

Day Two

6. Instruct students to lift the bowl, the mushroom cap, and the pencils from the construction paper very carefully. (Spores have stuck to the rubber cement and have made a design.)

7. Students can spray the designs with hairspray to preserve them and to give them luster.

GRADE 3
LIFE SCIENCE

UNIT: Fungi
TOPIC: Mushrooms
OUTCOME: 16. Compare a mushroom to a green plant.

Background

Mushrooms are non-green plants that lack roots, leaves, stems, and chlorophyll. They cannot make their own food. They live on dead plant matter in the soil. They grow very rapidly in warm, damp weather. Mushrooms are formed from hyphae, which are thread-like structures that grow underground. The hyphae form a cap underground that pushes up through the soil in damp weather. The mushroom has a stalk, a cap, and gills located under the cap. The gills contain spores. NOTE: Students should be cautioned that many mushrooms are poisonous and should not be handled. Mushrooms found in the grocery store are safe because they are a non-poisonous type.

Green plants contain chlorophyll and can make their own food. They require water, sun, soil, and air to survive and reproduce. Most green plants have roots, stems, and leaves. Green vascular plants depend on tubes to move needed water and nutrients from roots to leaves and back to roots.

Materials

- Pictures of mushrooms
- Pictures of green plants
- Green plant
- Mushroom

For each group:
- Small green plant
- Mushroom (may be purchased at a grocery store)

For each student:
- Handout: MUSHROOMS AND PLANTS

Procedures

1. Display pictures of various green plants for students to observe.

2. Write the label "Green Plants" on the chalkboard.

3. Ask students to observe the pictures and discuss the characteristics of green plants.

4. Write student observations on the chalkboard under the label "Green Plants."

OUTCOME 16 (Continued)

Procedures (Continued)

5. Show students a living green plant and ask them to match their observations of the pictured green plants with the live green plant.

6. Display pictures of several types of mushrooms.

7. Write the label "Mushrooms" on the chalkboard.

8. Ask students to observe the mushroom pictures and discuss any characteristics they see.

9. List the students observations on the chalkboard under the label "Mushrooms."

10. Show the students a mushroom and ask them to compare the characteristics of the real mushroom with those of the mushroom in the picture.

11. Divide students into groups of four. Give each student the handout MUSHROOMS AND PLANTS.

12. Tell students they are to use their handouts to list information about mushrooms and green plants and to make comparisons between the two.

13. Distribute materials to each group.

14. Rotate to each group and answer questions when necessary.

15. Upon completion of the activity, ask students if there are any more characteristics that might be added to either list on the chalkboard. If so, add them.

16. Ask students to describe the differences in the green plant and the mushroom. They are to write these differences on their handouts.

17. Instruct students to look for any likenesses in the green plant and the mushroom.

18. Discuss student comparisons and review characteristics of each plant listed on the chalkboard.

MUSHROOMS AND PLANTS
Handout

NAME: _____

Mushroom

Draw a Picture:

List Characteristics:

Green Plant

Draw a Picture:

List Characteristics:

_____

Describe any differences between mushrooms and green plants.

GRADE 3
LIFE SCIENCE

UNIT: Fungi
TOPIC: Helpful and Harmful Uses
OUTCOME: 17. Explore uses of yeasts, molds, and mushrooms.

Background

Yeasts are single-celled. Molds and mushrooms are multi-celled. All three are types of fungi. Fungi can be harmful or helpful to humans. Harmful molds can cause food to spoil, ringworms, and athlete's foot. Helpful molds are used in the manufacture of medicine such as penicillin and food such as cheese. Mushrooms can also be helpful or harmful. They can serve as food or as a poison. Yeasts can be helpful in making food and as a source of vitamin B. Yeasts can be harmful by spoiling food and causing diseases.

This activity will demonstrate some helpful uses of yeasts, molds, and mushrooms.

Materials

- Oven, or access to oven in the school cafeteria
- Yeast, 1 package
- Warm water, 2 tablespoons
- Sugar, 4 tablespoons
- Baking powder, 3 teaspoons
- Salt, 1 1/2 teaspoons
- Soda, 1 teaspoon
- Shortening, 1 cup
- Flour, 5 cups
- Buttermilk, 2 cups

For each student:
- Piece of mushroom
- Piece of cheese

Procedures

1. Place all ingredients for the biscuits (see recipe) on a table.

2. Preheat the oven to 400°.

3. Tell students that they are going to mix and bake yeast biscuits. Select nine students who will each measure and put one of the ingredients in the bowl. This activity will require the teacher's assistance.

OUTCOME 17 (Continued)

Procedures (Continued)

4. Follow the recipe carefully.

Yeast Biscuits

1 pkg. yeast
2 tbsp. warm water
4 tbsp. sugar
3 tsp baking powder
1 1/2 tsp. salt
1 tsp. soda
1 c. shortening
5 c. flour
2 c. buttermilk

The teacher will dissolve yeast in water and blend shortening with the flour. Add buttermilk and yeast; knead and put dough in a covered bowl in refrigerator. When chilled, roll out and cut. Arrange cut dough on the cookie sheet, and place it in the oven. Bake at 400° for ten minutes.

5. While the biscuits are cooking, place a piece of mushroom and a piece of cheese on a napkin for each student.

6. When the biscuits are cooked, give each student a biscuit. The students have then had the opportunity to taste all three of the fungi.

7. Lead a concluding discussion on the changes heat made to the dough, the release of carbon dioxide that made the yeast rise, and how some fungi can be helpful.

8. Allow students to go to the chalkboard and list some ways fungi (especially yeasts, molds, and mushrooms) can be harmful. Provide guidance if necessary.

GRADE 3
LIFE SCIENCE

UNIT: Fungi
TOPIC: Helpful and Harmful Uses
OUTCOME: 18. Explore harmful effects of fungi.

Background

Fungi are simple, non-green, plant-like forms. Although fungi can be helpful, they can also cause disease and decay. Two types of fungi are yeasts and molds. Some harmful activities of yeasts are spoilage of fruits, syrups, and jellies by fermentation, and diseases such as thrush. Molds can also cause food to spoil and cause diseases such as ringworm and athlete's foot. Molds and yeasts grow in warm, dark, and moist places.

This four-day activity will permit students to observe the harmful effects of fungi.

Materials

- Refrigerator
- Pictures of molds, yeasts, ringworm, and thrush

For each group:
- Bread and apple slices
- Empty margarine tub with lid
- Water, a few drops
- Handout: FUNGI

Procedures

Day One

1. Explain what fungi are and show pictures of diseases caused by fungi. (Visual aids from a medical source may be helpful.)

2. Continue the discussion with comments about damage caused by fungi.

3. Divide the class into three groups and give each group a margarine tub, bread, and apple slices.

4. Have students place their foods in the margarine tubs, add a few drops of water, and place the lids on the tubs.

5. Ask one group to place its tub of food in a sunny area, another group to place its tub of food in the refrigerator, and the third group to place its tub of food in a dark, warm area.

OUTCOME 18 (Continued)

Procedures (Continued)

6. Distribute the handout FUNGI to each group. Have students observe their food tubs for five days and record their observations (changes) on the handout.

7. On the sixth class day, have one member of each group tilt the tub and display its content while another member of the group reports any changes the group recorded.

8. After the groups have shared their findings with the class, help students decide the conditions under which fungi grow best. Discuss how harmful effects of these fungi can be reduced by avoiding such growth conditions.

FUNGI
Handout

OBSERVATIONS

	Day	1	2	3	4	5
Day 1	Bread: A (Sunny) B (Refrigerator) C (Warm,Dark,Moist)					
Day 2	Apple Slice: A (Sunny) B (Refrigerator) C (Warm,Dark,Moist)					
Day 3	Other Food: A (Sunny) B (Refrigerator) C (Warm,Dark,Moist)					
Day 4	Fungi appear to grow best _____					

NOTE: Use a "+" for fungus growth or a "-" for no fungus growth.

GRADE 3
LIFE SCIENCE

UNIT: Microorganisms
TOPIC: Protozoa
OUTCOME: 19. Identify three protozoa.

Background

Protozoa live and reproduce in water. They are commonly found in ponds, ditches, moist soil, or almost anywhere moisture can be found. They have cell structures and are alive, but they do not fall in either the plant or the animal category.

Amoeba move by a flowing of their cytoplasm. They do not have flagella or other swimming structures. They take in food by wrapping around it. These microscope animals are very common in the pond water; they drift, suspended in the water, and send strands of cytoplasm out through pores in the shell.

Euglena swim by vibrating the flagellum which is a long thread reaching out from a cell. There is a red eyespot near the front end. This is not an eye that sees things. It is simply a structure that is sensitive to light and allows the euglena to make its own food with its chloroplasts. It can also take in food molecules from the environment by absorbing them through the cell membrane.

Paramecium are covered with cilia (tiny hair-like structures) which give them better swimming ability than the other protozoa. The cilia beat the water like little oars moving paramecium through the water. Along one side of the cell is a mouth opening. Cilia send water that contains bacteria and other small bits of food through this mouth opening into the cytoplasm where it is collected in the food vacuole. When it becomes full of food, the food vacuole breaks away from the base of the mouth opening and is carried slowly around the cell by the moving cytoplasm. The food in each vacuole is digested and is absorbed by the cytoplasm. Materials that cannot be digested are forced out of the cell through a weak spot in the cell covering behind the mouth opening.

This two-day activity will help students identify at least three kinds of protozoa. This activity should be conducted during the warm months of the year. If students are taken on a collecting trip, safety precautions should be taken and careful instructions regarding safety rules should be given. At least one parent or another adult should be present to assist.

Materials

For each group:
- Handout: PROTOZOA
- Microscope
- Prepared slides of protozoa

OUTCOME 19 (Continued)

Materials (Continued)

- Glass slides
- Cover slides
- Small jar
- Small paper bag
- Shallow pan
- Water, from outdoor source

Procedures

Day One

1. If possible, take students on a specimen-collecting trip as described below:
   a. Locate a pond or other outdoor water source that is easily accessible. NOTE: Few organisms are found in moving water.
   b. Divide students into small groups. Provide each group with a jar and a paper bag.
   c. Accompany students to the outdoor water source. Have each group use the jar to collect a sample of water and some scum from the top of the water. Direct each group to collect twigs, leaves, and other dry materials from the area and place these in the paper bag. If an outdoor water source is not available for a field trip, collect samples and take them to class for the students to observe.

2. Prepare two or three slides of the water samples for each group.

3. Divide students into groups of four. (The number of students per group may be adjusted according to the number of microscopes available.)

4. Distribute slides, microscope, and the handout PROTOZOA to each group.

Day Two

1. For each group, prepare two or three slides of water in which the dry materials have been soaking.

2. Have students observe the slides, identify any protozoa types they find, and make drawings of the specimens. Ask students to compare their drawings with the handout PROTOZOA for identification of the kind of protozoa in their drawings.

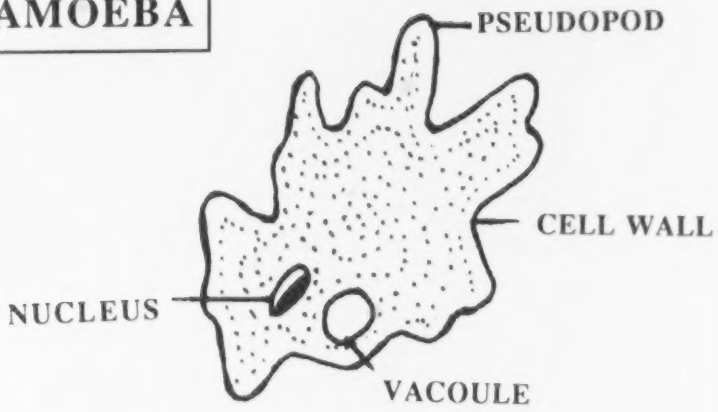
OUTCOME 19 (Continued)

Procedures (Continued)

3. Explain that protozoa have characteristics that do not allow them to be placed specifically into an animal or a plant category. They have characteristics of both. For example, some protozoa have chloroplasts. This characteristic is plantlike. Many have locomotor organelles (flagella and cilia). This characteristic is animallike.

PROTOZOA
Handout

AMOEBA



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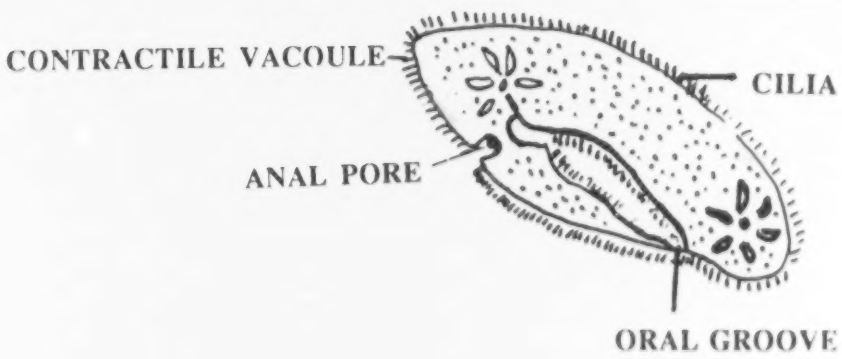

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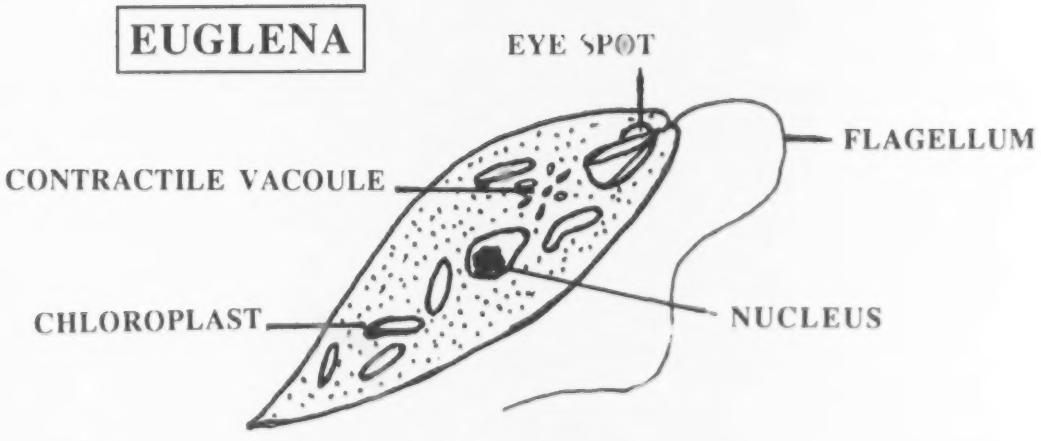


GRADE 3
LIFE SCIENCE

UNIT: Microorganisms
TOPIC: Bacteria and Viruses
OUTCOME: 20. Discuss diseases caused by viruses and bacteria.

Background

Bacteria are the smallest of the one-celled organisms. They can be found everywhere. They are classified according to one of three shapes: rod, spiral, or round. Bacteria cannot make their own food. They get food from dead and decaying plants and animals or food products. Some bacteria are helpful in breaking down the remains of dead plants and animals. Some bacteria are harmful and cause diseases such as tuberculosis, typhoid fever, and scarlet fever.

Viruses, like bacteria, are not classified as plant or animal. They enter a host cell and use the living processes of the cell to grow and reproduce. Viruses spread rapidly from cell to cell. They cause diseases such as measles, mumps, chicken pox, smallpox, polio, AIDS, the common cold, and flu. Viruses are sometimes transmitted through coughing, sneezing, touching, exchanging body fluids, and through carriers like flies and mosquitoes. Sometimes a vaccine is used to prevent a virus.

Materials

- Pictures of scientists such as Salk, Pastuer, Jenner, Koch, and Lister
- Book on different viruses and bacteria
- Pictures of bacteria
- Pictures of viruses
- Resource materials on Salk, Pastuer, Jenner, Koch, and Lister

Procedures

1. Ask students if they have ever had a cold or the flu.

2. Explain to students that these two diseases are caused by viruses. (Some colds are caused by bacteria.)

3. Tell students that bacteria can also cause diseases such as pneumonia and tuberculosis.

4. Ask students to think about ways diseases like colds and flu are spread. (Coughing, sneezing)

5. Ask students how they think viral diseases on the skin such as chicken pox, warts, and cold sores are spread. (Touching)

OUTCOME 20 (Continued)

Procedures (Continued)

6. Explain to students that some viruses are carried from person to person by insects like flies and mosquitoes.

7. Tell students that bacteria which cause pneumonia and typhoid fever can be transported through the air and into the body. The bacteria will not grow unless conditions are right for that particular type of bacteria. When conditions are right, the bacteria can grow and reproduce quickly.

8. Ask students how bacteria might be killed once growth has started.

9. Tell students that antibiotics are used inside the body to kill bacteria, and that disinfectants and germicides are used outside the body to kill the bacterial growth. Heat and ultraviolet rays from the sun are also used to kill certain bacteria.

10. Ask students who have had a childhood disease, a cold, or the flu what their parents or doctors did to help them get better.

11. Explain that many childhood diseases can be prevented with vaccinations.

12. Ask students to think of ways they can stop the spread of flu viruses and cold viruses. (Cover mouth when coughing or sneezing and throw away tissues.)

13. List the names Pastuer, Koch, and Lister on the chalkboard, and tell students that these scientists found a way to control some harmful bacteria. Ask students to use resource materials to find out about the work of these scientists.

14. List the names Jenner and Salk on the chalkboard, and ask students to investigate how these two scientists worked to identify and treat viruses like smallpox and polio.

15. Ask students to find out what other scientists have contributed to the identification and treatment of dangerous and harmful bacteria and viruses.

16. Emphasize ways the harmful effects of bacteria and viruses can be reduced. (Covering mouth when coughing or sneezing, using disinfectants, germicides, and antiseptics, getting vaccinated for diseases, and handling food properly.)

OUTCOME 20 (Continued)

Extension

1. List on the chalkboard the headings VIRUS and BACTERIA. Ask students to name diseases caused by each one. List each of those diseases on the board under the correct heading.

VIRUS	BACTERIA
Cold	Botulism (Toxins in food causing illness or death.)
Flu	Food poisoning (Toxins in food causing illness or death.)
Infectious pneumonia	Pneumonia
Polio	Typhoid fever
Smallpox	Tuberculosis
Chicken pox	Scarlet fever
Measles	Tetanus (lockjaw)
Mumps	Infected wounds
Rabies	
Hepatitis	
Yellow fever	
Infectious mononucleosis	
AIDS	

2. For each disease, discuss the body part infected, the treatment, and the prevention.

GRADE 3
EARTH SCIENCE

UNIT: The Solar System
TOPIC: Composition
OUTCOME: 21. Identify planets and their positions in the solar system.

Background

Constructing a model of our solar system is one way to introduce the concept that "everything has its place." This four-day activity is based upon the students' knowledge of the placement, distance from sun, and physical geography of each planet.

Please note the numerous materials needed. This activity requires three days for completion.

Materials

- Flashlight
- Poster board, one sheet
- Aluminum foil, one roll
- Paper punch, single hole
- Trash bags, one box
- Water, to mix paints

For each group:
- Balloon, 10" diameter
- Yellow punching ball, for the sun
- Flour, 5 pounds divided into ten half-pound amounts
- Two-quart container with tops
- Newspaper, 8"x 1" strips
- Dry tempera paint, blue, red, green, yellow, and white
- Medium art brushes
- Hot and cold cups, 6-ounce
- String,three-foot length (1)
- String, three-foot lengths (several for the star group)
- Tacks (30)
- Reference materials

Procedures

Day One

1. Divide the class into ten small groups of two or three students.

2. Assign nine of the groups a specific planet, and assign one group the stars.

3. Tell each group to use the reference materials to gather facts about the assigned planet or stars. Distribute poster board, aluminum foil, and string to the star group.

OUTCOME 21 (Continued)

Procedures (Continued)

4. Select a leader in each group to inflate and tie a balloon. The earth balloon should be inflated to a diameter of approximately eight inches. The size of the planet balloons should be adjusted in relationship to the size of the earth balloon.

5. Ask a student to distribute a two-quart container, flour, and water to each group. Have each group prepare a mixture of flour and water by adding water to the flour until a thin paste is formed.

6. Designate one student in each group to be the balloon holder. The other group members may begin dipping the newspaper strips into the flour mixture and forming a thin, slightly overlapping layer covering the entire balloon. Let balloons dry overnight.

7. While the planet groups are preparing their balloons, instruct the star group to cut stars from poster board. Suggest random sizes. Emphasize that shapes can vary.

Day Two

8. Mix the tempera paint and pour into hot and cold cups. Distribute paints to groups. Make sure that the color given to students is appropriate for the assigned planet. (Jupiter-red)

9. Have students carefully paint their papier mache' balloons the color or colors the teacher has distributed. Allow paint to dry overnight.

10. Have the star group cover both sides of their stars with aluminum foil. Use a paper punch to make a hole in each star and attach a string.

Day Three

11. The teacher will attach the trash bags to the ceiling for the background of the galaxy.

12. The leader of each planet group will attach a three-foot piece of string to the tail end of the papier mache' balloon planet.

13. As the planets are being tacked to their appropriate positions in the trash bag galaxy, ask each group to report to the class on the facts they have gathered about their planets.

OUTCOME 21 (Continued)

Procedures (Continued)

14. Members of the star group will tack the stars in position and report on stars in the galaxy.

15. Tack the sun, represented by the yellow punching ball, to its appropriate position in the trash bag galaxy.

16. Turn off lights and shine the flashlight to make the stars twinkle.

GRADE 3
EARTH SCIENCE

UNIT: The Solar System
TOPIC: Composition
OUTCOME: 21. Identify planets and their positions in the solar system.

Background

The awareness of Earth's place within the solar system can be made relevant by learning the positions of other planets. A self-explanatory teacher's key is included to help students identify the positions of planets. This activity is more meaningful to students if the previous activity is completed prior to beginning this activity.

Materials

- Tape
- Chart paper, large
- Markers
- Chalkboard

- For each group:
- Scissors

- For each student:
- Handout: THE PLANETS

Procedures

1. Draw lines to divide a section of the chalkboard (or chart paper) into three areas: a. Order, b. Distance from Sun, and c. Form. Under "Order," number one through nine.

2. Ask the students to name a planet. Write the name in its place under "Order." Continue to do this until all planet spaces are filled. (See the handout THE PLANETS, Teacher Key.)

3. Lead a discussion pertaining to the order of the planets, mentioning that the inner four are of rocky land form and that the outer five, except Pluto, are gaseous.

4. Ask students to assist in completing the other sections of the chart as those topics are discussed.

5. Distribute the handout THE PLANETS.

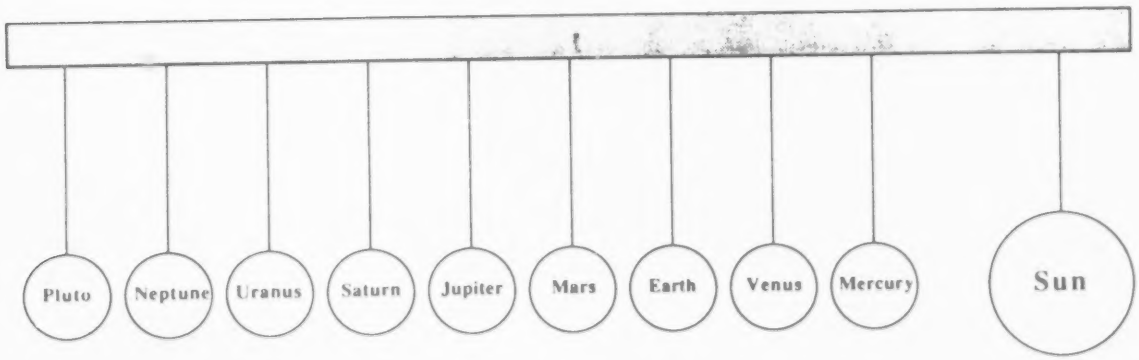
6. Have students use the chart to complete their handouts. These handouts can serve as study guides.

OUTCOME 21 (Continued)

Procedures (Continued)

7. Divide students into groups of four and distribute scissors and tape to each group. Instruct students to cut their handouts on the dotted lines to form strips. Have students place their strips in a pile in the center of the group and mix thoroughly. Direct the students to reconstruct the charts by sorting the strips and taping them together.

8. Display the reconstructed charts on the walls or bulletin board of the classroom.



THE PLANETS
Teacher Key

Order	Distance from Sun	Form
Mercury	36,000,000 miles	rocky solid
Venus	67,230,000 miles	rocky solid
Earth	92,960,000 miles	rocky solid
Mars	141,740,000 miles	rocky solid
Jupiter	483,700,000 miles	gaseous mixture
Saturn	855,200,000 miles	gaseous mixture
Uranus	1,781,000,000 miles	gaseous mixture
*Neptune	2,788,000,000 miles	gaseous mixture
*Pluto	3,660,000,000 miles	uncertain**

*Positions of Neptune and Pluto may vary. Refer to current data for information.

**The form of gas may be solid frozen.

THE PLANETS

Handout

Order	Distance from Sun	Form

GRADE 3
EARTH SCIENCE

UNIT: The Solar System
TOPIC: Planetary Movements
OUTCOME: 22. Demonstrate the nine planets orbiting the sun.

Background

To understand the orbits of each planet better, a visual aid is needed. Each planet has its unique orbit around the sun. The end product of this activity is a bulletin board display of planets and their orbits around the sun. Appropriate reference materials need to be available to provide accurate information.

Materials

- Large bulletin board
- Yarn, one skein
- Bulletin board background paper
- Stapler

For each group:
- Stencil letters
- Sentence strips
- Marker
- Reference materials

Procedures

1. Divide the class into nine small groups. Provide each group with one sentence strip, one marker, and access to stencil letters.

2. Label one sentence strip with the word "sun." Staple the sentence strip in the center of the bulletin board.

3. Assign each group a planet. Ask the students to stencil the name of the planet on the sentence strip.

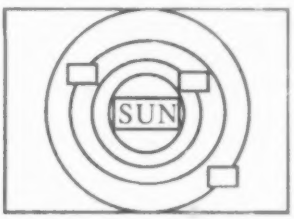
4. Beginning with Mercury, ask each group to determine the location of its assigned planet.

5. Select a student from each group to staple the planet name in the approximate position. Continue this process until all planets are stapled on the bulletin board.

OUTCOME 22 (Continued)

Procedures (Continued)

6. Form orbits around the sun with yarn to illustrate the orbits of the planets. NOTE: All orbits are not circular.



7. Use the bulletin board to demonstrate the orbit of each planet. Remove specific planet names and orbits. Let the students rebuild the model by replacing the planets in their proper positions.

GRADE 3
EARTH SCIENCE

UNIT: Solar System
TOPIC: Rotation and Revolution of Earth and Moon
OUTCOME: 23. Demonstrate causes of day and night.

Background

The earth is the third planet from the sun in the solar system. The earth revolves around the sun in an orbit or path. The earth's revolution around the sun affects the seasons on the earth. As the earth travels in its orbit around the sun, it also rotates or spins on its axis. The earth's rotation on its axis causes day and night.

It takes about 24 hours for the earth to rotate once (turn completely around on its axis). The time it takes for the earth to make a complete rotation is called a day. A day on earth lasts about 24 hours.

While the earth rotates, part of it faces the sun, and the light from the sun shines on that part of the earth. The rest of the earth faces away from the sun and is in darkness. Over a period of hours, as the earth continues to rotate, the part of the earth that faced the sun turns away from the sun. The part of the earth that is in darkness is experiencing night. The part of the earth that faces the sun is experiencing day.

The earth rotates from west to east. As the earth turns toward the east, the sun appears to "rise" or come up in the sky as the day begins. As the earth rotates, the sun appears to "set" or go down in the west in the late afternoon.

Materials

- Transparency Master: DAY AND NIGHT

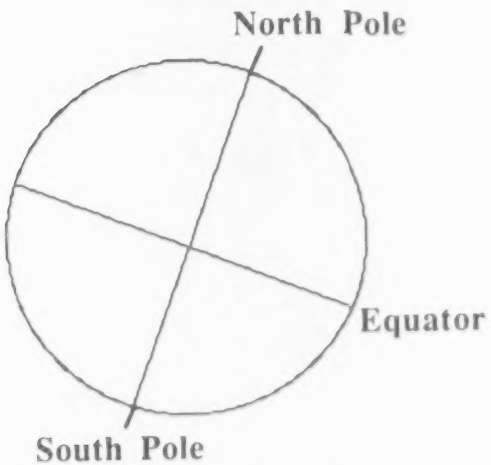
For each group:
- Globe
- Flashlight
- Sheet of chart paper
- Marker

OUTCOME 23 (Continued)

Procedures (Continued)

1. Hold up a globe in front of the class and point out where the imaginary axis of the earth is located. Explain to students that the axis of the earth is an imaginary line from the North Pole through the center of the earth to the South Pole. On the chalkboard or on a transparency, draw the outline of the earth and draw the axis. Mark the North and South Poles and draw and label the Equator.

THE EARTH



2. Explain to students that the earth rotates on its axis as it revolves around the sun. Turn the globe to illustrate the rotation of the earth.

3. Direct a student to hold a flashlight in front of the class and to turn it on. Explain that the flashlight is representing the sun, and its light represents the light that shines from the sun.

4. Turn out the lights in the room. Hold the globe so that the light from the "sun" falls in a straight line onto the globe. Explain to the students that for several hours one part of the earth has daylight, while the rest of the earth is in darkness. Rotate the globe and demonstrate how the part having day, after a period of hours, will turn away from the sun's light and be in darkness (night). Show the transparency DAY AND NIGHT to illustrate. Discuss the transparency.

OUTCOME 23 (Continued)

Procedures (Continued)

5. Ask one student to come to the globe and point to any country on the globe. Ask the student to identify the name of that country. (It is not necessary for the student to point to a country he or she knows.) Hold the globe so that the country is facing toward the "sun." Ask the student to look at the part of the earth that is facing away from the light of the "sun," and to point to a country in this part of the earth. Assist the student in identifying the name of the country.

6. Explain to the students that while it is daytime in the first country, it is night in the second country. Rotate the globe and show how it will be night in the first country while it is daytime in the second country.

7. Make a chart on the chalkboard similar to the example given.

DAY	NIGHT
United States	
	United States

8. Ask students to name several of the countries. On the chart write the names of those countries. Encourage students to list about six easy-to-find countries. Place the name of each country in the day column or in the night column. Vary the placement.

9. Divide the class into six small groups. Distribute to each group a globe, a flashlight, a sheet of chart paper, and a marker.

OUTCOME 23 (Continued)

Procedures (Continued)

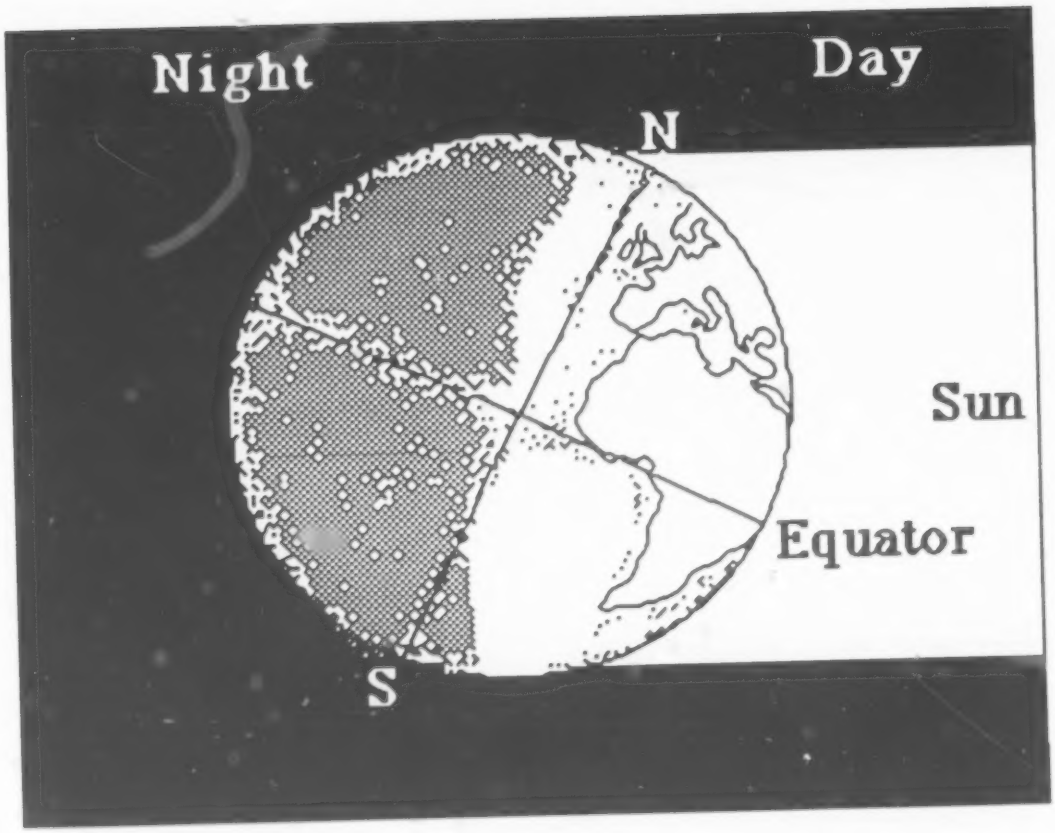
10. Turn off the lights in the classroom. Direct one student in each group to represent the "sun," and shine the flashlight on the globe. Ask one student to hold the globe so that a country listed on the chart is facing the "sun" and having day or facing away from the "sun" and having night. Remind students that they must look to see in which column the country has been placed. After the first country has been positioned correctly, the group should look for the name of a country that is having the opposite part of the day. The name of this country should be written in the correct column on the group's chart. Work with each group to ensure that the task is understood.

11. Direct each group to repeat the process until each country has been located and its opposite country has been identified and written on the chart. Encourage the students to alternate tasks within the group.

12. When all charts have been completed, discuss the results with the students. Have each group report its findings. Encourage the students to give the reasons why the first country is having day and the second country is having night, or vice versa.

13. Display the completed charts.

DAY AND NIGHT
Transparency



GRADE 3
PHYSICAL SCIENCE

UNIT: The Solar System
TOPIC: Rotation and Revolution of Earth and Moon
OUTCOME: 24. Demonstrate how the earth's axis and orbit are related to seasonal changes.

Background

The earth's axis is tilted at an angle of 23 1/2 degrees and is always pointed toward the North Star. Because of this tilt, and because of the earth's revolution around the sun, the earth has different seasons. When the northern hemisphere is tilted toward the sun, the earth has summer. The combination of longer daylight hours plus the sun's direct rays causes the season of summer to be warm. When the northern hemisphere is tilted away from the sun, the earth has winter. In winter, the sun's rays shine at a slant and nights are longer than the days. These factors help cause the northern hemisphere to be much colder in winter.

Materials

- Globe
- Gooseneck lamp

For each group:
- Flashlight
- Shoe box lid
- Crayons

Procedures

1. Place a globe two feet to the left of a gooseneck lamp with the globe's axis tilted toward the lamp. Turn off the lights in the classroom. Ask students which season this would be with the sun's rays striking the northern hemisphere directly. (Summer) Spin the glove slowly. Point out that the daylight hours are longer in the northern hemisphere.

   Move the globe to the opposite side of the lamp so that the tilt is away from the lamp. Ask the students which season this would be. (Winter)

   Place the globe in the spring and fall positions. Be sure students conclude that the daylight hours for the northern and southern hemispheres are equal.

OUTCOME 24 (Continued)

Procedures (Continued)

2. Divide the class into four or five small groups. Give each group a flashlight and a shoe box lid. Direct one student in each group to hold the box lid upright (vertically) and another student in that group to shine the flashlight into the box lid. Then have the student holding the box lid tilt it until it is in a vertical position. Ask the student with the flashlight to shine it into the box lid again. Allow all the students in each group to participate in the experiment. After everyone has had a turn, repeat the experiment and have one student in each group use a crayon to trace the circle of light at the two different angles. Ask students which circle is larger and why.

Extension

Direct students to describe the experiment in writing, explaining how the direct rays and slanted rays of the sun affect the seasons.

GRADE 3
EARTH SCIENCE

UNIT: Solar System
TOPIC: Rotation and Revolution of Earth and Moon
OUTCOME: 25. Describe movements and phases of the moon.

Background

The moon revolves around the earth in an elliptical orbit. The point of the orbit closest to the earth is the perigee, and the point of the orbit farthest from the earth is the apogee.

The moon rotates on its axis and revolves around the earth, just as the earth rotates on its axis and revolves around the sun. It takes the earth 24 hours to rotate (spin around) on its axis, but it takes the moon 27 1/3 days to rotate one complete turn on its axis. It takes 365 days (plus a few hours) for the earth to make a complete revolution around the sun; however, it takes the moon only 27 1/3 days to revolve around the earth. This means that a day on the moon is the same length as a year on the moon. This also means that the same side of the moon always faces the earth.

The moon has no light of its own. The moon reflects light from the sun. As the moon revolves around the earth, sometimes more and sometimes less of the moon's surface appears to be lighted. For this reason, the moon looks as if it has different shapes at different times of the month. These different "shapes" of the moon are called phases of the moon. The moon goes through its phases every 29 1/2 days.

Phase

New Moon:	When the moon is in the direction of the sun, the side toward the earth is dark.
Waxing Crescent:	The moon continues to move in its orbit around the earth, and gradually its lighted area appears to grow larger.
First-quarter phase:	About one week after the new-moon phase, the moon has traveled one-fourth of its way around the earth. One-half of the moon appears to be lighted.
Waxing-gibbous phase:	More and more of the light from the sun can be seen reflected from the moon.

OUTCOME 25 (Continued)

Background (Continued)

Full moon:	About two weeks after the new moon, the entire lighted side of the moon can be seen. The earth is somewhere between the moon and the sun, but the earth does not keep the light of the sun from being reflected by the moon.
Waning-gibbous phase: Last quarter phase: Waning-cresent phase:	Less and less of the light from the sun can be seen reflected from the moon. It takes the moon two weeks to pass through these three phases.

The phases of the moon then start over with the new-moon phase.

Materials

- White circles, 12 inches in diameter (9)
- Black circles, 12 inches in diameter (9)
- Script: THE PHASES OF THE MOON
- Flashlight

Procedures

1. Assign students to represent characters in the skit THE PHASES OF THE MOON.

2. Distribute the white or black circles to the designated student.

3. Follow the directions as given on the script for the appropriate characters.

4. Allow students to perform and contribute any additional props they find are necessary.

THE PHASES OF THE MOON
Script

Characters:	Sun, Earth, Moon, New Moon Phase, Waxing-Crescent Phase, First-Quarter Phase, Waxing-Gibbous Phase, Full Moon Phase, Waning-Gibbous Phase, and Last Quarter Phase.
Sun:	(Stands on the left in front of the class and holds a lighted flashlight) "I am the sun. I shine all the time. The earth and all the other planets revolve around me. I furnish light, heat, and energy for the solar system."
Earth:	(Stands on the right in front of the class facing the sun) "I am the earth. I rotate on my axis, and I revolve around the sun. When one side of me faces the sun, my countries on that side are having day. When a side of me faces away from the sun, my countries on that side are having night."
Moon:	(Stands between the sun and the earth) "I am the moon. I rotate on my axis, and I revolve around the earth. I do not have any light of my own. I reflect light from the sun. As I move around the earth, I seem to make different shapes because only a part of me reflects the sunlight. These different shapes are called phases, and I have eight phases every 29 1/2 days. My size and shape do not change, but the lighted part seen on earth does." (Sits down)
New-Moon Phase:	(Walks up and stands between "sun" and "earth," position A, and holds one white circle and one black circle) "I am the New-Moon Phase of the moon. During my orbit around the earth, the side of the moon that faces the earth does not get any light from the sun, and it is dark. The people on earth can not see me." (Illustrates by placing black circle over white circle, then, sits down)

Waxing-Crescent Phase: (Stands where the New-Moon Phase stood) "I am the Waxing-Crescent Phase of the moon. As I move in my orbit around the earth, more of me shows the reflected light." (Walks east from the sun, holding the black circle in front of the white circle, then gradually uncovering more of the white circle on the side closer to the sun until one-half on the "moon" is white. (Stops at position B and sits down)

First-Quarter Phase: (Walks over and stands at Position B) "One week after the New Moon, I have traveled one-fourth of the way around the earth. One-half of me reflects the sun's light." (Holds up circle showing one-half white, one-half black, then sits down)

Waxing-Gibbous Phase: (Stands at position B) "I am the Waxing-Gibbous Phase of the moon. As I travel toward the half-way point on my trip around the earth, more and more of me reflects the light from the sun." (Walks toward position C)

Full-Moon Phase: (Stands at position C, facing the earth and holding a white circle) "About two weeks after the New-Moon Phase, people on earth can see all of the side of the moon that is facing earth. I am the Full-Moon Phase."

Waning-Gibbous Phase, Last-Quarter Phase, and Waning-Crescent Phase: (One student stands at position C) "I represent the last three phases of the moon. While I am the Waning-Gibbous Phase, less and less of the light from the sun can be seen on me." (Walks to position D)

"It takes one week to reach the Last-Quarter Phase on my trip around the earth. It takes another week to reach where I started. This is the Waning-Crescent Phase. Less and less of the moon can be seen." (Gradually covers up more and more of the white circle while walking toward position A and stops at position A) "And here I am at the New-Moon Phase. Remember: I don't change. I am the same size and shape all month."

GRADE 3
PHYSICAL SCIENCE

UNIT: The Solar System
TOPIC: Rising of the Sun
OUTCOME: 26. Recognize that the sun appears to rise in the east and to set in the west.

Background

Because of the earth's counter-clockwise rotation, the sun seems to move across the sky from east to west. Therefore, the sun appears to rise in the east and set in the west.

Materials

- Globe
- Flashlight

For each student:
- Handout: MAP

Procedures

1. Shine the flashlight on the globe and slowly turn the globe counter-clockwise. Ask students to observe that the east receives the light of the "sun" before the west does.

2. Assist students in locating and labeling the cities listed on the handout MAP. Instruct the students to answer the questions on the handout independently.

MAP
Handout

Label these cities on the Map:

-Dallas, Texas
-Sacramento, California
-Charlotte, North Carolina
-St. Louis, Missouri
-Albuquerque, New Mexico
-Jackson, Mississippi
-Atlanta, Georgia
-Chicago, Illinois

____1. In which city does the sun rise first, (a) Sacramento, or (b) Charlotte?

____2. In which city does the sun set first, (a) Jackson, or (b) Albuquerque?

____3. In which city does the sun rise first, (a) Atlanta, or (b) St. Louis?

____4. In which city does the sun set first, (a) Chicago, or (b) Dallas?

GRADE 3
EARTH SCIENCE

UNIT: Resources of the Earth
TOPIC: Surface Changes
OUTCOME: 27. Observe and discuss changes in the surface of the earth caused by wind, water, and volcanoes.

Background

Many forces are at work changing the surface of the earth. Some of these forces such as wind, rain, and rushing water are more easily observed than forces deep inside the earth. Millions of tons of soil and rocks are moved daily from one place to another through the actions of wind and water. This process is called "erosion." The faster and more forcefully the wind and water move, the greater the amount of soil is lost to erosion. Some examples of the effects of water forces include the following: rain water rushing down a hillside taking soil with it, waves pounding against a shoreline eroding the soil and rocks, deep gorges and canyons eroded by wind, water, rivers, and floods.

A volcano is a mountain or hill formed when hot molten rock is blown out of a crack in the earth's crust. The rock inside the earth is very hot, but it is solid because of pressure on it. When the pressure on part of this rock is reduced, such as through a crack in the earth's crust, liquid magma is formed.

Magma flows to the earth's surface through the crack that was formed or through a weak spot in the crust. When magma reaches the surface, it is called lava. Sometimes the lava hardens to form rough, jagged surfaces, and other times it hardens to a smooth, ropy surface.

Wind changes the surface of the earth by collecting tiny particles of soil and debris and distributing them against rocks with such force that, over long periods of time, the abrasive action of the wind causes the rocks to erode. Many times the rocks will take strange shapes that look like animals, buildings, and other things that are part of the environment. Dust storms caused by wind moving upon loose, unprotected soil can move millions of tons of soil across several states. (Trees used as windbreaks can reduce soil erosion due to wind.) Examples of the effects of wind upon the land are the shifting sands of the Sahara Desert and the dust storms that occur in the western part of the United States.

The three parts of this activity will require approximately two weeks to complete.

OUTCOME 27 (Continued)

Materials

- Erosion trays, two small cookie sheets (2)
- Sprinkling cans, identical (2)
- Plastic dish pans (2)
- Water
- Several old books
- Soil
- Leaves, twigs, and small rocks
- Collection of small rocks
- Coffee can with lid
- Paper towels
- Stiff cardboard

Procedures

Conduct the two sections of Part 1 of the activity outside or on a surface that will not be damaged by soil and water. Explain how both wind and water change the surface of the earth. Tell students they are going to participate in some activities that show the effects of wind and water on soil.

Part 1

Section A. Wind

1. Have students sit in a circle. Choose one student to place several small rocks in the coffee can. Ask the student to secure the lid tightly.

2. Direct the first student in the circle to place one hand over each end of the can. Tell the student to shake the can vigorously. Students should pass the can around the circle until each student has had a chance to shake the can.

3. After all students have shaken the can of rocks, direct one student to empty the contents of the can onto a paper towel.

4. Direct students to notice the particles and soil that have been loosened by the abrasive action. Point out that wind has a similar abrasive effect on rocks.

5. Have a student place several spoonfuls of loose soil on a paper towel that has been placed on a table. Select two or three students to stand on one side of the dirt and, using a cardboard "fan," fan the soil vigorously. Does the soil move? Have the students increase the speed of the fanning and describe what happens.

OUTCOME 27 (Continued)

Procedures (Continued)

Section B. Water

1. Have two students place equal amounts of soil into the erosion trays. Tell the students to smooth the soil.

2. Have students place leaves, twigs, and small rocks over the soil in one of the erosion trays. Tell students to leave the other tray with only soil in it.

3. Tell students that they will sprinkle equal amounts of water over each tray. Ask the students to guess which tray's contents will wash away first, the plain soil or the soil with debris on it.

4. Use old books to form an incline. Place the trays on the books and place dish pans at the bottom of the trays. Have students assist as much as possible.

5. Choose two students to operate the identical sprinkling cans. Fill cans with equal amounts of water (about a quart) and start the sprinkling at the same time. The run-off will be collected in the dish pans.

6. Use paper towels to filter the soil that has collected in the dish pans. Ask which tray lost the most soil due to erosion? Have students give reasons.

7. Vary the incline in the trays. Use plain soil in both trays. Use less soil in the trays and add more rocks. Repeat the experiment and have students discuss their observations.

Part 2

This part of the activity addresses the creation of a new landform through the birth of (building) a volcano. This activity is designed to promote creativity; therefore, only guidelines and suggestions are given in building the volcanoes. Students are encouraged to use their own ideas, within the given guidelines.

In the week prior to this part of the activity, students should be instructed to bring items from the suggested materials list to class to build their volcanoes. Materials may be placed in a central location where they may be selected at a later date. Students may need to be assigned to groups at this time in order to plan materials to be brought into the classroom.

OUTCOME 27 (Continued)

Procedures (Continued)

This part of the activity will take a minimum of four days to complete. During this period of time, the students will diagram a plan for building their volcanoes, build a supporting structure, cover its surface with a material, and paint it so that it resembles a volcano.

The materials suggested may be shared with the students in order to stimulate their creativity. Students are not required to use any of the materials listed; however, the items listed work well in building a model volcano.

Materials (Suggested)

For each group:
- Clay flower pot, 10"-12"
- Plastic soft drink container cut in half, 3-liter (to use as a base)
- Poster board
- Soup can
- Paper cup, 5-ounce
- Heavy cardboard squares for volcano base
- Newspaper strips
- Liquid starch

Materials

- Masking tape
- Glue
- Paint
- Brushes
- Mixing bowls
- Spoons
- Flour
- Salt
- Water
- Food coloring

For each group:
- Handout: SUGGESTED METHODS FOR COVERING VOLCANOES

Procedures

Day One

Developing a plan

1. Assign students to groups of four.

2. Instruct each group to develop a strategy for building its volcano.

3. Encourage students to share ideas and be creative in their plans for building their volcanoes.

OUTCOME 27 (Continued)

Procedures (Continued)

4. Ask students to diagram their plans, list materials needed, and devise methods of construction.

5. Advise students of these guidelines for constructing volcanoes.

   a. Each volcano must contain a chamber to hold liquid if it is to be used for eruptions. The chamber needs to be an opening in the top of the crater with a depth of no more than two inches (example: five-ounce paper cup).

   b. The volcano must be built upon a base so that it may be transported easily.

Day Two

Building the volcano support

1. Instruct students to gather needed materials.

   a. Make sure students include a base (cardboard square) upon which the volcano is to be built.

   b. Make sure students include a chamber container (five-ounce paper cup) to hold any liquid in the chamber.

2. Instruct students to build supporting structures for their volcanoes by using their diagrams developed in Day 1 as a guide.

Day Three

Covering the support structure

1. Instruct students to cover the supporting structure with a material that will camouflage the items used. Students may use the methods suggested in the handout SUGGESTED METHODS FOR COVERING VOLCANOES or any method of their own to cover their volcano supports.

Day Four

Painting the structures

1. Instruct students to paint the structures (when dry) to resemble volcanoes.

2. Suggest that students landscape the areas around the volcanoes.

3. Display the volcanoes for viewing.

OUTCOME 27 (Continued)

Procedures (Continued)

4. Discussion: A follow-up discussion should include the observations made while constructing the volcanoes. Relate the effects of real-life weather conditions such as rain or wind upon the birth of a volcano. Have students list ways weather conditions may change a volcano's formation.

Materials

For each group:
- Pre-made volcano with chamber to hold liquid
- Table or undisturbed area
- Plastic to cover workspaces
- Flour
- Baking soda or baking powder
- Vinegar
- Food coloring
- Measuring cups
- Spoon
- Container to mix vinegar and food coloring
- Electric fan
- Sprinkling can to simulate rain

For each group:
- Handout: SUGGESTED METHODS FOR COVERING VOLCANOES
- Handout: VOLCANO OBSERVATION

For each student:
- Handout: EFFECTS OF WIND, WATER, AND VOLCANOES

Procedures

Section A

1. Divide the class into groups of four.

2. Place volcanoes in a workspace that will remain undisturbed until completion of the activity.

3. Protect the workspace with plastic covering.

OUTCOME 27 (Continued)

Procedures (Continued)

4. Instruct each group to do the following:

   a. Make a mixture of equal parts of baking soda or baking powder and flour. (Amount of mixture depends on size of chamber.)

   b. Place flour mixture in the volcano chamber. The chamber should be three-fourths full.

   c. Mix vinegar with food coloring in a container.

   d. Pour a small amount of the vinegar mixture into the volcano chamber. Observe the eruption. Stir the mixture until the eruption ceases. If any flour mixture remains, pour more vinegar mixture into the chamber for continued eruptions.

   e. Repeat the process after the "lava" dries from the previous eruptions.

5. Have each group use the handout VOLCANO OBSERVATION to keep a daily record of the visual changes on the surface of the volcano.

Section B

1. Repeat the process after the lava dries from the previous eruption (approximately two days).

2. Place a blowing fan near an erupting volcano. NOTE: The fan must blow on the volcano until the next eruption.

3. Make inferences about reasons for changes in the earth's surface due to the addition of wind.

4. Have each group use the handout VOLCANO OBSERVATION to keep a daily record of the visual changes of the surface of the volcano.

Section C

1. Repeat the process after the lava dries from the previous eruption (Procedure 4, steps A through D of Part A).

2. Allow lava to dry for one day.

3. Instruct each group to sprinkle water on volcanoes to simulate rain.

4. Instruct students to record observations on their handouts.

OUTCOME 27 (Continued)

Procedures (Continued)

5. Have students repeat the process (Procedure 4, steps A through D of Part A).

6. Tell students to "rain" on the volcano immediately after its eruption.

7. Have each group use the handout VOLCANO OBSERVATION to record observations.

Section D

1. Distribute to each student the handout EFFECTS OF WIND, WATER, AND VOLCANOES.

2. Use the handouts VOLCANO OBSERVATION and EFFECTS OF WIND, WATER, AND VOLCANOES to initiate a discussion about the surface changes due to the eruption of lava, wind, and water.

3. Instruct the students to answer the questions on the handout EFFECTS OF WIND, WATER, AND VOLCANOES.

4. Display the volcanoes and the observation sheets for others to view.

SUGGESTED METHODS FOR COVERING VOLCANOES
Handout

Salt Dough

- Mix equal parts flour and salt.
- Add water until mixture forms a soft ball.
- Add food coloring to mixture if color is desired.

Papier Mache'

- Papier mache' paste (flour and water mixed to the consistency of heavy cream)

or

- Liquid starch
- Torn newspaper strips

Soak newspaper strips in paste or starch

EFFECTS OF WIND, WATER, AND VOLCANOES
Handout

1. What did the "lava" do to the area surrounding your model volcano?

2. What would happen to real life plants, animals, buildings, and other things if they were in the path of hot, flowing lava?

3. How does lava from a volcano destroy things?

4. Do you think the rate at which the lava dries has an effect on its appearance?

5. How can wind change the appearance of the lava?

6. How does the eruption of a volcano build up a mountain?

7. How can water change the surface of a mountain?

8. How can wind, water, and volcanoes build up the earth's surface as well as destroy it.

VOLCANO OBSERVATION
Handout

Diagram the appearance of your volcano daily

M	T	W	TH	F	M	T	W	TH

In the space below your picture make a statement about your diagramed observation.

GRADE 3
EARTH SCIENCE

UNIT: Resources of the Earth
TOPIC: Composition of Earth
OUTCOME: 28. Identify the composition of the earth.

Background

The earth is made up of three layers. They are the crust, the mantle, and the core. The crust is the outer layer. It is composed of a thin layer of rock approximately 48 kilometers (30 miles) at its thickest point and 11 kilometers (7 miles) at its thinnest point. The mantle lies beneath the crust. It is made up of hot, solid rock approximately 2900 kilometers (1800 miles) deep. The third layer is made up of two parts; the outer and inner cores. The outer core is made up of hot, liquid metals. The outer core surrounds an inner core of hot, solid metals.

The purpose of this activity is to illustrate the layers of the earth. A model ice cream earth is made by layering different colors of ice cream in a large bowl. The crust layer is made by mixing green ice cream with crushed graham crackers to represent the soil and various other of the 90 elements found in the earth's crust. Chocolate ice cream with nuts and/or marshmallows mixed throughout is used to represent the hot, solid rock made up of a gas (oxygen), nonmetalic (silicon), and metalic (aluminum, iron and magnesium) elements of the mantle. Gray ice cream and silver edible spheres are used to represent the melted iron and nickel of the outer core.

The inner core is depicted by orange sherbert to represent the extreme temperatures of hot rock. Edible silver spheres are mixed with the orange sherbert to represent the high concentration of solid iron and nickel in the inner core.

When the activity is completed, it will resemble one half of the earth as viewed from the inside. The layers will be plainly visible and easy to identify because a different color is used to represent each layer.

The activity requires several hours of preparation. Each layer must be allowed to freeze before the next layer is added. The amount of ice cream required depends upon the size of the bowl. Each ice cream layer should follow the contour of the bowl.

In advance, prepare a large chart of the layers of the earth, or diagram the layers on the board. An illustration of the chart is contained in this activity. Prior to this activity, a discussion of the size of each layer should take place.

OUTCOME 28 (Continued)

Materials

- Chocolate ice cream (with nuts and/or marshmallows)
- Vanilla ice cream
- Orange sherbert
- Red, green, and yellow food coloring
- Graham crackers
- Dragees (edible silver spheres)
- Paper plates
- Forks or spoons
- Large bowl
- Large tray
- Large knife
- Paper towels
- Ice cream scoop

Procedures

Part A Making the ice cream earth

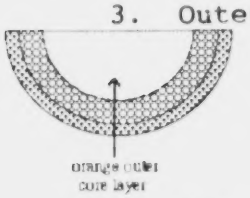
1. Crust:

a. Mix green ice cream (add green food coloring to vanilla ice cream or use pistachio ice cream) and crushed graham crackers.
b. Make a thin crust layer following the contour of the mixing bowl.
c. Freeze until firm.

2. Mantle:

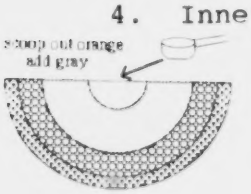
a. Use chocolate ice cream with nuts and/or marshmallows.
b. Place on top of green crust layer following the contour of the previous layer.
c. Freeze until firm.

3. Outer Core



a. Use orange sherbert with dragees sprinkled throughout.
b. Place on top of the chocolate mantle layer and fill the bowl.
c. Freeze until firm.

4. Inner Core



a. Scoop out orange sherbert to make a space about the size of a tennis ball for the inner core . (Layer size depends upon size of bowl.)
b. Use gray ice cream (equal amounts of red and green food coloring added to vanilla ice cream) with a high concentration of dragees.

OUTCOME 28 (Continued)

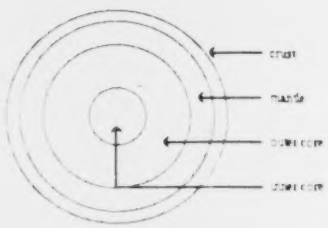
Procedures (Continued)

c. Fill scooped-out space.
d. Freeze until hard (overnight or at least six hours).

Part B Observing and eating the ice cream earth

1. Allow frozen model to remain at room temperature until it is melted enough to be removed from the bowl.

2. Ask students to look down into the bowl and identify the layers.



3. Compare layers of ice cream earth to the teacher-made chart or board diagram.

4. Turn the earth upside down on large tray.

5. Allow the ice cream model to drop from the bowl onto a tray.

6. Cut the earth in half.

7. Observe and identify the layers of the ice cream model.

8. Slice and serve quickly.

9. Eat!

GRADE 3
EARTH SCIENCE

UNIT: Resources of the Earth
TOPIC: Characteristics of Rocks
OUTCOME: 29. Classify rocks according to weight, color, smoothness, hardness, or formation.

Background

The solid part of the earth's crust is made up of great masses of hard material called rock. All rocks can be divided into three main groups: igneous, sedimentary, and metamorphic. Rocks are made up of one or more minerals. Minerals are chemical elements that are found naturally in the earth's crust. Identifying minerals is done by testing the properties or characteristics that the minerals have. Some of the properties that are tested are color, smoothness, hardness, and weight.

Set up four stations, each with five rock or mineral samples. At each station a different property will be examined for classification. With masking tape, label each sample "A," "B," "C," "D," or "E." (Hobby shops or natural history museums sell a variety of rock samples.)

Materials

For each station:
- Rock and mineral samples (5)
- Penny
- Steel file
- Hand lens
- Balance scale
- Plastic cup
- One cup of sand

For each student:
- Handout: TABLES

Procedures

1. Divide the class into four groups for rotating to the four stations. Provide each student with the handout TABLES. Direct students to record their observations of these properties: color, smoothness, weight, and hardness.

   a. Color will be observed visually, using a magnifying glass.

   b. Smoothness will be examined by touch and observation.

OUTCOME 29 (Continued)

Procedures (Continued)

c. Weight will be determined in the following manner. Place a plastic cup of dry sand on the balance scale. Direct students to compare its weight with the rock samples, one at a time. (The weight of rocks cannot be scientifically tested in this experiment. That would involve determining the specific gravity. This demonstration shows that a rock has weight and its weight can be compared with another substance.)

d. Hardness will be estimated by conducting a scratch test. Briefly explain the Moh's Scale of Hardness (see a science resource book or encyclopedia). Instruct students to do a scratch test on the rocks. Using a fingernail (hardness number 2), a penny (hardness number 3), and a steel file (hardness number 6), the hardness of the samples can be estimated according to Moh's Scale of Hardness.

2. Have each group staple their observation sheets together into a booklet. The cover of the booklet can be decorated with illustrations of various types of rocks.

Extension

Ask students to bring a favorite rock to class. With pieces of felt, permanent markers, and other art supplies, the rocks can be decorated to portray clothes and facial features. Encourage students to name their "Pet Rocks." Have a Pet Rock parade.

TABLES
Handout

ROCK	COLOR DESCRIPTION
A	
B	
C	
D	
E	

ROCK	HEAVIER THAN SAND	LIGHTER THAN SAND
A		
B		
C		
D		
E		

ROCK	SMOOTH	ROUGH
A		
B		
C		
D		
E		

ROCK	HARDNESS NUMBER
A	
B	
C	
D	
E	

GRADE 3
EARTH SCIENCE

UNIT: Resources of the Earth
TOPIC: Formation of Rocks
OUTCOME: 30. Recognize that heat, cold, running water, plants, and people help to break rocks into pieces.

Background

There are many forces that act upon the face of the earth and deep within it to cause the breaking up of rocks and the forming of new ones. Rocks are classified into three kinds: igneous, sedimentary and metamorphic.

Igneous rocks come from hot molten material. Some are formed when hot lava flows from a volcano and cools on the earth's surface. Most igneous rocks are formed deep beneath the earth's crust from a hot molten material called magma. The magma flows, cools, then solidifies deep within the earth. Most igneous rock is the bedrock of the world called the mantle.

All rocks formed by deposits of small particles or by chemicals in solutions are called sedimentary rocks. When forces work on igneous rocks they often become sedimentary rocks. One type of sedimentary rock is formed when water gets between the minerals that form granite, the most common igneous rock. As the water freezes and thaws, the rocks disintegrate. Large pieces of quartz disengage from the rock and break into smaller pieces. The smaller pieces break into still smaller pieces called sand. Water and acid work on the granite to form clay. The particles are then carried by water to the ocean. As the layers of sediment build-up, the weight of the layers consolidates them to form new rocks. Many other types of rocks are formed as a result of the breaking up of rocks due to chemical forces or weathering, and the redistribution of the broken particles.

Metamorphic rock is the third type of rock. It is formed deep within the earth's crust when igneous and sedimentary rock are changed chemically by heat and pressure.

While rocks on the earth's surface are being broken down, redeposited, and joined together in different forms, rocks deep within the earth are being changed by heat and pressure created by the movement of hot magma and internal forces. Generally, this movement happens very slowly; but, when it is rapid, earthquakes, volcanic eruptions, tidal waves, and other naturally occurring phenomena take place.

Plants and people are two other factors that break rocks into pieces. As plant seeds are deposited by natural forces they find their way between rocks.

OUTCOME 30 (Continued)

Background (Continued)

When the plants mature, the stems force their way upward and move rocks apart. The roots also find any space available to move into and grow, causing the displacement of the rocks around the plants.

People break rocks into small pieces daily. Machines are used to cut into mountains, to build roads, or to mine ore. Rocks are used in building and are crushed to use on roads as ground cover.

In this activity, students will observe how the force of water, combined with cold temperatures, can break rocks into pieces. Water is frozen inside baby food jars. The expansion of the ice causes the jars to break, thus simulating breaking rock.

Great caution should be taken when dealing with broken glass. Instructions are given for the jars to be placed inside plastic freezer bags before they are placed in the freezer. However, depending upon the maturity level of the class, this activity may need to be done as a whole-group teacher demonstration instead of by students.

This activity will take two class periods.

Materials

- Water
- Masking tape
- Markers

For each student:
- Baby food jar with lid
- Reclosable freezer bag (sandwich size)

Procedures

1. Instruct students to do the following:

    a. Fill baby food jars to the rim with water.
    b. Place lids on the jars tightly.
    c. Put each jar inside a reclosable freezer bag.
    d. Use markers to write names of students on pieces of tape, and place them on the bags.
    e. Put the bags in the freezer overnight.

2. Ask students to predict what will happen to the jars and to give reasons for their predictions. (The water will expand as it freezes, causing the jars to break or the lids to be pushed off.)

. On the following day, carefully remove the bags from the freezer.

OUTCOME 30 (Continued)

Procedures (Continued)

4. Distribute the bags to students.

5. Instruct students to observe the contents of the bags, but caution them not to open the bags.

6. Discuss the results of the experiment with students.

7. Carefully collect the plastic bags.

8. Discuss what other forces break rocks into pieces. Include the following: heat, cold, running water, plants, and people.

Extension

This activity may be repeated with water-soaked limestone, sandstone, or brick. Freezing water will cause some of the rock to crumble.

GRADE 3
EARTH SCIENCE

UNIT: Resources of the Earth
TOPIC: Composition of Soil
OUTCOME: 31. Identify particles found in a sample of soil.

Background

Soil is a naturally occurring mixture of minerals and organic materials. There are many kinds of soil. Each soil has certain characteristics, including color and composition. There are three basic types of particles found in soil. They are sand, silt, and clay. Sand particles are largest and can be easily identified. They give soil its gritty feeling or texture. Silt particles are smaller than sand particles. They feel like flour when rubbed between the fingers. Clay particles are the smallest. They cannot be seen by the human eye. Since they are so small and light, they will float on water. Pure clay is sticky; silt is not.

Materials

For each student:
- Samples of sand, clay, and silt, labeled A, B, and C.
- Paper cup, 5-ounce
- Spoons
- Paper plates
- Handout: DISCOVERING DIRT (3)

Procedures

1. Divide the class into groups of three. Label each group member A, B, or C.

2. Instruct each group member to obtain a soil sample (A, B, or C) corresponding to the assigned letter.
   a. Direct students to label a cup A, B, or C.
   b. Direct students to use a spoon to scoop the appropriate soil sample into the cup.

3. Distribute three handouts DISCOVERING DIRT to each student.

4. List the three types of soil particles on the chalkboard.

5. Instruct students to examine their own soil samples and complete one handout.

6. Have students use spoons to place soil on plates for closer examination.

OUTCOME 31 (Continued)

Procedures (Continued)

7. Instruct students to rotate within the group and complete a handout for each soil sample.

8. Repeat until all samples have been observed and recorded.

9. Discuss the completed handouts.

Extension

Mix together samples of sand, clay, and silt, and have students identify individual particles of each.

DISCOVERING DIRT
Handout

Your Name: _____

Members of your group: _____

Soil Sample Label: _____

Directions:

1. Select one soil sample.
2. Place some of the soil in the paper plate.
3. Use your senses to observe the soil.
4. Record your observations on the lines below.
5. Use the following cues to help you make your observations.

A. TOUCH _____

B. SMELL _____

C. SIGHT _____

D. SHAPE _____

E. WEIGHT _____

A. Feel: gritty, smooth, wet, etc.

B. Smell: earthy, moldy, damp, etc.

C. Composition: organic materials, rocks, twigs, etc.

D. Particle shape: round, angular, smooth, etc.

E. Weight: compare with other soil samples.

Is your soil sample silt, sand, or clay?

_____

GRADE 3
EARTH SCIENCE

UNIT: Resources of the Earth
TOPIC: Uses of Soil
OUTCOME: 32. Discuss uses of soil.

Background

Soil is made up of water, air, and mineral particles ground up finely over a period of time by friction, rainfall, and erosion. Not all soils are the same. Different soils have different characteristics. One property of soil is texture. Texture tells the amount of sand, silt, and clay in a particular soil. The largest and coarsest particles are sand. The smallest particles are clay. The texture of silts is between that of sand and clay. Sand is found on the beach. Most sand particles can be seen without the aid of a magnifying glass. All sand particles feel rough when rubbed between the fingers. Sand particles help the soil stay loose and allow water and air to move through it. If soil contains too much sand, it will not retain water or food. That is why it is hard to grow plants in sandy soil. Not many plants are found at the beach.

Silt feels like flour or talcum powder when rubbed between the fingers. When wet, it feels smooth, but not sticky. A magnifying glass or microscope is required to see the particles. Silt keeps soil rich and loose. Soil with silt in it will hold water; yet, this soil will not get sticky when wet and not too hard when dry.

Clay is the smallest soil particle. A single clay particle is too small to be seen with a magnifying glass. Clay holds a large amount of water. Clay particles feel sticky to the touch when wet. When clay particles dry, they clump together and become very hard. The best soil has just enough clay particles to hold water and plant food for growth.

Soil is one of the most important natural resources. Soil is used to grow food, to make homes for animals, to make bricks and concrete, to hold moisture and heat, and for many other things.

Plants help man to live not only by serving as food, but also by giving off the oxygen needed for survival. In this activity, students will explore one use of soil by growing plants.

Materials

For each student:
- Potting soil
- Three seeds (vegetables or flowers)

OUTCOME 32 (Continued)

- Water
- Paper cup
- Spoon or plastic cup to dip potting soil

Procedures

1. Brainstorm with students about the uses of soil.

2. Make a list of these uses on the chalkboard.

3. Discuss the uses listed.

4. Discuss the three types of soil particles.

5. Ask students to predict which type of soil would be best for each of the uses listed on the chalkboard.

6. Help students to infer the kind of particles found in potting soil.

7. Distribute one paper cup and three seeds to each student.

8. Instruct students to do the following:

   a. Fill the cup half full with potting soil.
   b. Plant three seeds in the cup.
   c. Water the seeds until the soil is moist.
   d. Place the cup in a sunny area where seeds will grow.

9. Have students keep a journal for two weeks to record and illustrate the growth process and change.

GRADE 3
EARTH SCIENCE

UNIT: Resources of the Earth
TOPIC: Conservation of Soil
OUTCOME: 33. Explore ways to conserve soil.

Background

Conservation is the management of the environment to ensure sufficient supplies of natural resources for future generations. Conservation has become increasingly necessary due to man's capabilities for exploiting and changing the environment. Society will lose much of its resource base unless man plans for the future and ends practices that harm the environment. Since land is a major resource, the conservation of soil must be considered.

In this activity, students will explore various methods of conservation. Completion of this activity requires a 17-day period of time. Prior to this activity, students need to have discussed the various types of soil (clay, silt, and sand) and where each type may be found.

Materials

For each group:
- Boxes, photocopy paper box tops (3)
- Soil, various types
- Foil, extra heavy, and wide width
- Tool to punch holes in box top
- Seeds for grass, sprouts, or any type of ground cover that germinates rapidly
- Labels for boxes (3)
- Items to be used for landscaping:
  - rocks or stones
  - gravel
  - small plants resembling small trees or shrubs
  - miniature buildings made from milk cartons, small cans or other boxes
  - sod or ground covering
- Landscaping tools
- Foil tins to be used to collect water
- Sprinkling can with line marked to measure one-half gallon
- Glass or clear plastic measuring cups, one-quart size, (3)
- Electric fan
- Table
- Handout: SOIL CONSERVATION OBSERVATION SHEET

OUTCOME 33 (Continued)

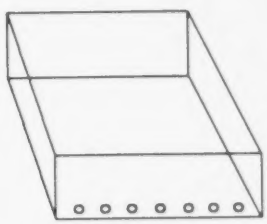
Procedures

Day One

Part A. Preparation of Soil Beds

1. Divide the class into groups of five. Distribute three boxes to each group.

2. Instruct each group to do the following:
   a. Line each box with foil (sides and bottom).
   b. Make five to seven holes in the bottom of each box through the foil liner:



   c. Fill each box two-thirds full of soil.
   d. Place two of the boxes in an undisturbed area until ready for use.

Part B. Simulation of Gound Covering (Soil bed 1)

1. For each group, place one soil bed in a work area.

2. Instruct students to do the following:
   a. Plant seeds in soil bed.
   b. Water seeds as necessary.
   c. Label box "Ground covering/Grass-1" (or whatever seeds are used).
   d. Label box with names of group members.
   e. Place bed in an undisturbed observation area.

Two weeks later (Day Fifteen)

Part A. Designing a Landscape (Soil bed 2)

1. Instruct each group to draw a design of a landscape that illustrates the conservation of their soil bed.

2. Have students label all items in the design.

3. Encourage students to bring in items to make the design as realistic as possible.

OUTCOME 33 (Continued)

Procedures (Continued)

4. Remind students to use items that control erosion for landscaping.

Part B. Landscaping the Soil Bed

1. Using the landscape design as a guide, have each group build a model of a landscaped area from the soil bed.

2. Water the plants if necessary.

3. Label the box "Landscaped-2"

4. Label the box with names of group members.

5. Place the landscaped beds in an undisturbed observation area.

Part C. Exposing a River Bed (Soil Bed 3)

1. Instruct each group to create a river bed out of the soil bed.

2. Suggest to students that they may add additional soil types to get the river bed to hold shape.

3. Remind students to use only soil, no ground covering.

4. Label the box "Riverbed-3"

5. Label the box with names of group members.

6. Place the river bed in an undisturbed observation area.

Day Sixteen

Rain and Wind

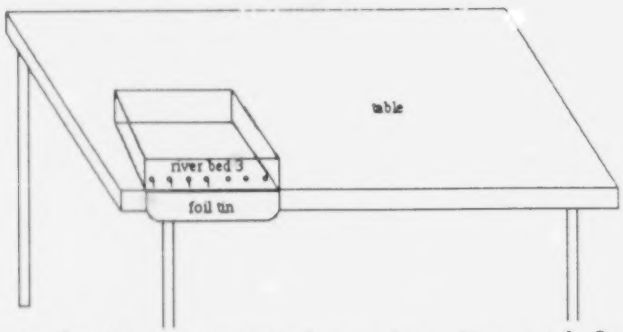
1. Have each group do the following:
   a. Place all three soil beds on the edge of a table.
   b. Elevate one end of each soil bed approximately 45 degrees. (Have students elevate each soil bed at the end that has no holes in order to ensure proper drainage.)

2. Distribute the following items to each group:
   a. Three foil tins
   b. Sprinkling can with water filled to one-half gallon line
   c. Three glass measuring cups
   d. Electric fan

OUTCOME 33 (Continued)

Procedures (Continued)

3. Assign one member from each group to be in charge of the following:
   a. Soil bed 1 (ground covering)
   b. Soil bed 2 (landscaped)
   c. Soil bed 3 (river bed)
   d. Sprinkling can and water
   e. Electric fan



4. Have students, assigned in 3a, 3b, and 3c hold foil tins under the holes of the soil beds to catch "rain."

5. Place the fan equal distance from all three soil beds. Turn on the fan and let it continue to blow during the "raining" process.

6. Instruct students to "rain" on soil bed 1, using all the water (one-half gallon) in one can.

7. Repeat "raining" with soil beds 2 and 3.

8. Instruct students to continue to hold foil tins under the draining water until all water stops.

9. Have students pour collected "rain" water into the glass measuring cups.

10. Place the glass measuring cups in an undisturbed observation area until the next day.

11. Return soil beds to the observation area.

12. Turn off the fan.

Day Seventeen

1. Instruct each group to check the amount of soil that settled to the bottom of each glass measuring cup from the "rain", and record it in the appropriate column of the handout SOIL CONSERVATION OBSERVATION SHEET (example: 1/4 cup soil- 1 cup water).

OUTCOME 33 (Continued)

Procedures (Continued)

2. Instruct students, then, to record on the handout the amount of rain collected.

3. Encourage students to record observations concerning the amount of erosion occurring in each soil bed due to the amount of ground coverings used.

4. Ask students to conclude which method of conservation is most beneficial.

5. Lead students to discover that methods of conservation may depend upon the topography of an area.

SOIL CONSERVATION
OBSERVATION SHEET
Handout

Group Members:

	Amount of Soil Measured	Amount of Water Measured
Soil Bed 1 Groundcover		
Observation:		
Soil Bed 2 Landscaped		
Observation:		
Soil Bed 3 Riverbed		
Observation:		

Conclusion:

GRADE 3
PHYSICAL SCIENCE

UNIT: Machines
TOPIC: Simple Machines
OUTCOME: 34. Identify how machines make work easier.

Background

There are six types of simple machines: levers, pulleys, wedges, screws, inclined planes, and wheels. This activity will allow students to experiment with some of these machines and realize how machines help make work easier.

Mount the pulley before starting this activity.

Materials

- Large book
- Rope, 20' long x 1" in diameter
- Pulley and mount
- Wrench
- Student desk with bolt in leg
- Dolly
- Visual: Machine Pictures

Procedures

1. Gather all materials. Select students to try to lift a large book. Tell the students to be careful. After two or three students try to lift the book, tell them there is an easier way to accomplish this task.

2. Assemble the pulley with the rope. Tell them a pulley is a machine. Ask students how the pulley can be used to move or lift the book.

3. Assist a student as he or she guides the brick onto the dolly. Ask students to tell how the dolly might be used. Answers may vary.

4. Point out the components of the two machines the students have used (rope, pulley wheel, and dolly as a lever).

5. Show students the block, rope, pulley wheel, wrench, dolly and desk. Ask students to identify the items that have not been used. After identifying the desk and wrench, select a student to attempt to loosen the bolt manually.

6. Following the manual attempt, ask the same student to try loosening it with the wrench. (Some loosening may need to be done by an adult).

OUTCOME 34 (Continued)

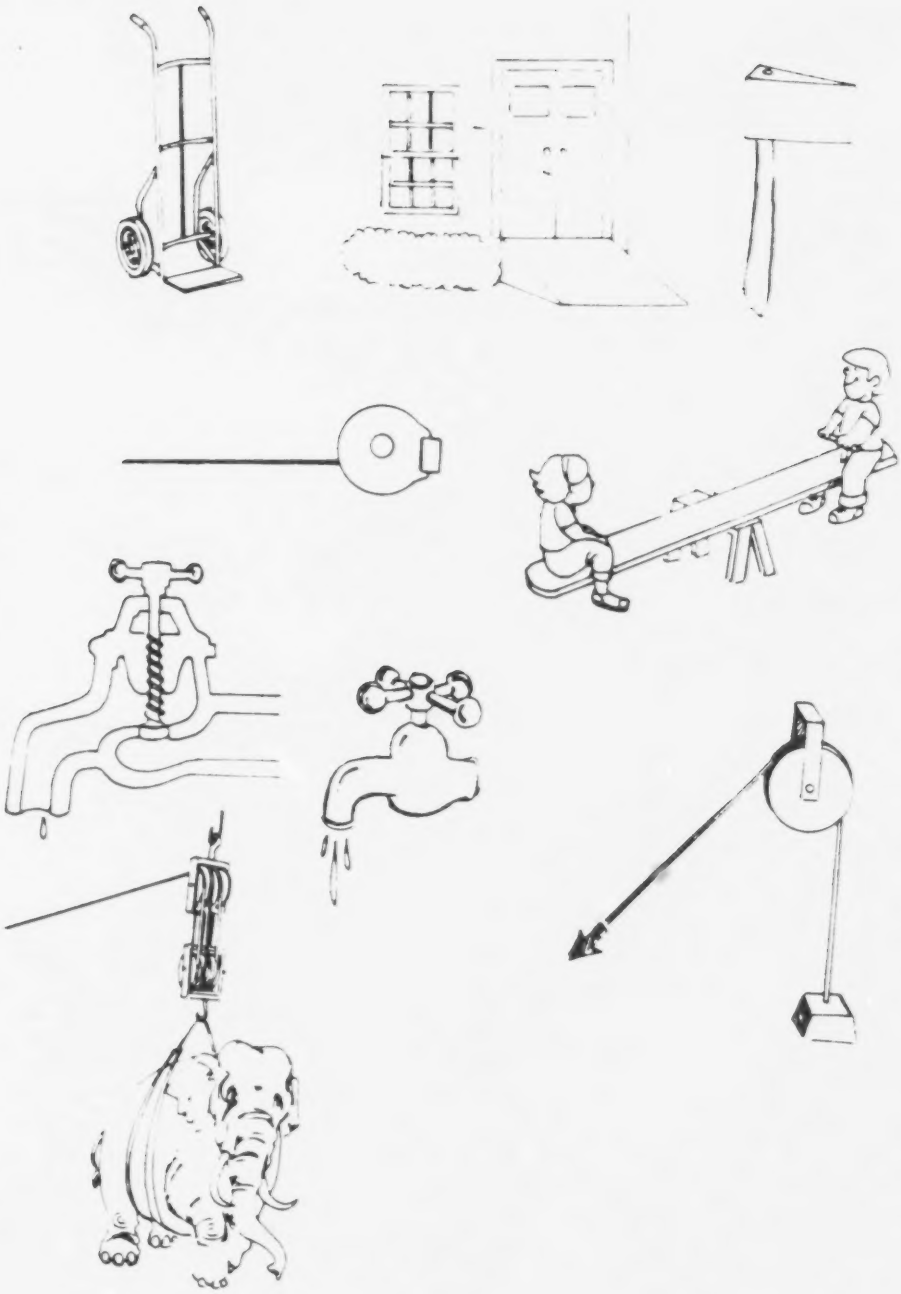
Procedures (Continued)

7. Display the pulley, dolly, and wrench. Ask individual students to identify which machines helped make the movement of the block and the bolt easier.

8. Lead a discussion on how wheels, levers, and pulleys help make work easier in other situations. (This may include such tasks as changing a tire, hanging out clothes, and turning on a water faucet.)

9. Ask students to identify pictures of such machines as a wrench, a tire jack, a dolly, and a clothes line with a pulley.

MACHINE PICTURES
Visual



GRADE 3
PHYSICAL SCIENCE

UNIT: Machines
TOPIC: Simple Machines
OUTCOME: 35. Identify six simple machines: levers, pulleys, wedges, screws, inclined planes, and wheels.

Background

Much of the work of the world is done by machines. Machines make work easier. Simple machines cannot produce energy. Instead, they use the energy supplied to them by other sources. Simple machines serve to increase speed, to increase force, and to change the direction of a force. This activity will introduce students to six simple machines: the lever, the pulley, the wedge, the screw, the inclined plane, and the wheel.

Examples of these machines, such as household tools or school equipment, will be needed.

Materials

Examples of simple machines:
- Lever: Crowbar, seesaw
- Wheel and axle: Pencil sharpener, eggbeater, door knob
- Inclined plane: Ramp, slide, board and books
- Wedge: Ax, chisel, knife, tack
- Screw: Large screw, car jack in use, wrench turning a bolt
- Pulley: Wheel and cord used to raise flags, blinds, or curtains

For each student:
- Handout: DEFINITIONS

Procedures

1. Give each student a copy of the handout DEFINITIONS.

2. Use the definitions to introduce simple machines. After discussing each definition, read each definition and have a student choose the object it identifies.

3. Assign students the task of bringing to class toys that exemplify the six machines. Have a show-and-tell hour with the toys.

Extension Activities

1. Invite a carpenter to bring tools and show their uses.

2. Visit a manufacturing plant to see machines at work.

DEFINITIONS
Handout

Pulley:	A wheel with a grooved rim in which a rope is threaded in order to change the direction of the pull.
Wedge:	A piece of wood, metal, or other material used in splitting or separating.
Screw:	A cylinder with a ridge winding around it.
Lever:	A bar for raising a weight at one end by pushing down at the other end.
Inclined plane:	A ramp. (A plane is a flat surface. Incline means to slant.)
Wheel and axle:	A device consisting of a cylindrical axle on which a wheel is fastened.

GRADE 3
PHYSICAL SCIENCE

UNIT: Machines and their Uses
TOPIC: Complex Machines
OUTCOME: 36. Identify simple machines that compose complex machines.

Background

Machines help make work easier. Some machines multiply force. Other machines move the force from one place to another. Machines can increase the distance and the speed of a force or change the direction of a force. The six simple machines are the lever, the wheel and axle, the pulley, the inclined plane, the wedge, and the screw. When any two or more simple machines are joined together into one machine, it is called a complex or compound machine. A complex machine multiplies the force of the simple machine and allows for increased productivity.

In preparation, several objects listed in the materials section should be gathered prior to this activity. Students may want to bring several of the objects. Ask a student who rides a bicycle to school to bring the bicycle into the classroom the day of the activity.

Materials

- Pencil sharpener
- Hand can opener
- Meat grinder
- Toy dump truck
- Egg beater
- Hand drill
- Bicycle
- Pictures or examples of the six simple machines
- Scissors

For each student:
- Drawing paper, 8 1/2" X 11"
- Handout: COMPLEX MACHINES

Procedures

1. Review with students the six simple machines and list them on the chalkboard.

2. Ask students for examples of each simple machine and list the examples on the chalkboard under the name of the appropriate machines.

3. Display pictures or examples of the six simple machines.

4. Explain to students that a complex machine is a machine made up of two or more simple machines.

OUTCOME 36 (Continued)

Procedures (Continued)

5. Display scissors for the students to observe.

6. Ask students to identify the simple machines found in the scissors (two levers and a wedge).

7. Tell students that when when two or more simple machines are used together in a complex machine, the force of the simple machines is increased.

8. Display a bicycle and ask students to identify any of the six simple machines.

9. Direct students to name and indicate the different simple machines they can identify on the bicycle (wheel and axle and gears).

10. Discuss each of those simple machine and its use.

11. Distribute paper to each student. Place the six complex machines at different locations around the classroom.

12. Distribute to each student the handout COMPLEX MACHINES.

13. Divide the class into six groups.

14. Tell the students to examine each complex machine carefully and find the simple machines that are used in each.

15. For each complex machine, ask students to place a check in the column under the simple machine they find in that complex machine. Demonstrate how to complete the handout. Tell students they will be asked to locate the machine and to describe how it works.

16. Assign each group one complex machine as a starting point.

17. Give the students a time limit and tell them to rotate from one machine to the next until they have finished with all the machines or time is called.

18. When time is called move to each machine and ask students for the data from their charts.

19. Select several students to demonstrate the simple machines in each complex machine.

20. Review the activity by identifying simple machines that compose complex machines.

COMPLEX MACHINES
Handout

Complex Machine	Lever	Pulley	Wheel & Axle	Wedge	Screw	Inclined Plane
Hand Drill						
Can Opener						
Pencil Sharp-ener						
Egg Beater						
Meat Grinder						
Toy Dump Truck						

GRADE 3
PHYSICAL SCIENCE

UNIT: Machines
TOPIC: Friction
OUTCOME: 37. Discover that friction makes work more difficult and also causes heat.

Background

Energy is the ability to do work. Work occurs when energy is transferred from one object to another, generally as movement of an object from one place to another.

Machines neither create nor destroy energy. They simply transfer energy from one source to another. However, some energy is required to operate a machine during the transfer process. On the surface, it may appear to "waste" energy; but, as stated earlier, energy cannot be destroyed. The energy that appears to be lost is actually changed into another type of energy. One main type of energy change is when heat energy is produced by the force of friction between the moving parts of a machine.

Before conducting the activity, arrange three centers in the classroom. Center One will contain a piece of carpet. Center Two will contain a roll of aluminum foil and a thermometer, and Center Three will contain a bicycle.

Materials

- Carpet piece
- Aluminum foil
- Thermometer
- Bicycle, turned upside down or turned on its side

Procedures

1. Have students select partners. Explain the procedures for students to follow at each center. (Partners will help each other and let the teacher know when students are ready to rotate to another center.)

Procedures for Centers

Center One

1. Take off one shoe.
2. Quickly rub your stockinged foot over the carpet.
3. Pay attention to what your foot feels.

OUTCOME 37 (Continued)

Procedures (Continued)

4. Rub your hand or other body part over the carpet . Pay attention to what you feel.

Center Two

1. Tear a piece of foil 6"x 6".

2. Quickly rub your fingers over the foil. Keep doing it until you get tired.

3. Quickly wrap the foil around the base of the thermometer. Hold the thermometer at the top, away from the foil and notice the temperature change.

Center Three

1. Ask your partner to spin the bike wheel.

2. Quickly touch the wheel with the palm of your hand.

3. Notice what you feel.

2. After each student has had a turn at each center, ask the students to form one large group.

3. Question the students about what their feet, hands, and other body parts felt when they rubbed the carpet and touched the spinning tire. Ask students about the temperature change when they wrapped the aluminum foil around the base of the thermometer.

4. Tell students that energy is the ability to do work, and that motion is the product of a form of energy applied to an object. Tell students that friction is a force that opposes motion and causes the energy of motion to be changed to heat energy. Guide the discussion so that students will generalize that friction causes heat. Include the following questions: Why did the students' feet become warm when rubbed against the carpets? (The movement of the feet was acted upon by the force of friction against the carpet. Since energy is transferred when movement occurs and the carpet could not move to receive and continue to transfer that energy, the energy was changed from movement to heat.)

   Why did the foil become warm when the students rubbed it? The movement of the hand is a result of a force applied to the hand by the muscles. This movement is interfered with by the non-moving foil. The energy of motion from the hand is changed to heat energy, thereby heating the foil.

GRADE 3
PHYSICAL SCIENCE

UNIT: Machines
TOPIC: Reduction of Friction
OUTCOME: 38. Demonstrate how lubrication will reduce friction.

Background

Lubricants aid in the reduction of friction and wear. Substances such as oil and grease can be used as lubricants to make things easier to move. This activity helps demonstrate the changes lubricants can make.

Materials

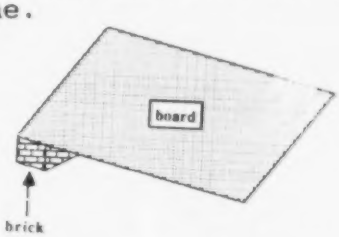
- Oil, silicone spray
- Petroleum jelly
- Brick
- Board, 1'x 3'
- Roller skate
- Match box car
- Measuring tape
- Chart: ROLLER DERBY

For each student:
- Graph paper

Procedures

1. Ask the students to form a semicircle.

2. Select a student to place the brick and the board on the floor to form an inclined plane.



3. Select another student to place the skate on top of the board. Direct the student to release the skate so that it can roll down the board.

4. Assign a student to record on the chart ROLLER DERBY the rolled distance. (This is done by measuring from the top end of the board to the front wheels of the skate.) Complete this experiment three times and average the distances the skate rolled.

5. Choose another student to release the skate on top of the

OUTCOME 38 (Continued)

Procedures (Continued)

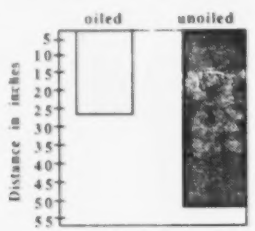
board. Before releasing the skate, tell the student to put some oil on the wheels.

6. Tell the class what the student is doing and ask the students to predict if the skate will roll farther than before the wheels were lubricated. Roll the skate down the inclined plane three times and average the distances rolled.

7. The recorder will measure and average the new distances.

8. Post the recorded measurements so that each student can observe them.

9. Ask each student to draw a bar graph showing the contrast of distances before and after oiling the skate.



10. Locate a squeaky door or drawer. Let the students hear it squeak. Ask a student to oil it. Discuss the difference in its sound before and after oil is applied.

11. Have students cite the advantages and disadvantages of using lubricants.

ROLLER DERBY
Chart

ROLLER DERBY I

The distance from the top of the board to the stopping place of the skate's front wheels is _____ inches.

ROLLER DERBY II

The distance from the top of the board to the stopping place of the skate's front wheels is _____ inches.

	_____	inches in Roller Derby II
minus	_____	inches in Roller Derby I
Equals a difference of	_____	inches caused by reducing friction

GRADE 3
EARTH SCIENCE

UNIT: Matter and Energy
TOPIC: Properties and States of Matter
OUTCOME: 39. Discover that matter takes up space and has weight.

40. Recognize that matter exists in four states: solids, liquids, gases, and plasma.

Background

Matter is anything that occupies space and has weight. Matter ordinarily exists in three physical states: solids, liquids, and gases. A fourth state called plasma exists under special conditions. This activity does not address plasma because it cannot be seen by the naked eye. The activity, however, shows that matter takes on various shapes, depending upon given boundaries.

Allow a minimum of two class days for this activity.

Materials

- Sturdy balloons, labeled A, B, C, D (4)
- Helium balloon, with string attached, labeled E
- Flattened helium balloon, one from which the helium has escaped, labeled F
- Water, having water pressure from a water faucet
- Dishpans (2)
- Refrigerator with freezer
- Gelatin dessert
- Measuring cups
- Mixing bowl
- Boiling water
- Trays
- Paper towels
- Scissor or knife to remove balloon from ice formation.

Materials for each student:
- Paper cup (5-ounce)
- Paper plate
- Handout: STATE OF MATTER OBSERVATION (3)
- Pencil
- Plastic spoon

OUTCOMES 39 and 40 (Continued)

Procedures

Day One

Preparing examples of states of matter.

Discuss with students the three states of matter. Mention the fourth state, plasma, and explain that plasma can not be seen by the naked eye. Ask students to give examples of each state of matter.

In a group setting, prepare examples of each of the three states of matter.

1. Gases

    a. Show students two uninflated balloons (labeled A and B).
    b. Inflate one of the balloons with air (A).
    c. Discuss with students how air (gas) takes up space.
    d. Show students the inflated helium balloon (E).
    e. Let balloon E rise to the ceiling.
    f. Show students the flattened balloon F (one from which the helium has escaped).
    g. Compare the balloons containing gas with those without gas.
    h. Set balloons aside until day two.

2. Liquids

    a. Attach two uninflated balloons (labeled C and D) to a water faucet (one at a time).
    b. Slowly inflate each balloon with water.
    c. Tie the balloons closed.
    d. Place the balloons in two separate dishpans.
    e. Set balloon C aside until day two.
    f. Place the dishpan containing balloon D in the freezer until day two.

3. Solids

    a. Prepare gelatin dessert as directed on the package.
    b. Pour gelatin dessert into the paper cups (one per student).
    c. Place paper cups on trays.
    d. Place gelatin dessert in the refrigerator until day two.

OUTCOMES 39 and 40 (Continued)

Procedures (Continued)

Day Two

Observing states of matter.

Part A. Preparation of stations

1. Gas Station
   a. Tie the helium balloon labeled E to a stationery object.
   b. Place uninflated helium balloon F beside helium balloon E at Gas Station-1.
   c. Place air-inflated balloon A beside uninflated balloon B at Gas Station-1.

2. Liquid Station

   Place balloon C and the dishpan at Liquid Station-2.

3. Solid Station

   a. Remove frozen balloon D from the freezer.
   b. Place the dishpan containing balloon D at Solid Station-3.
   c. Remove the trays containing jello cups from refrigerator.
   d. Put gelatin dessert cups and frozen balloon at Solid Station-3.
   e. Have students observe the cutting of the balloon from the frozen water to reveal a solid ice shape.

Part B. Instructions to be given students at stations.

Divide the class into three groups (1, 2, and 3). Distribute to each student three handouts STATES OF MATTER OBSERVATION, one spoon, and one paper plate. Instruct students to place the spoons and paper plates on their desks. Students should take the three handouts STATES OF MATTER OBSERVATION and a pencil with them as they rotate through the stations.

1. Gas Station-1

   a. Instruct students to observe the balloons.
   b. Have each student complete one handout STATE OF MATTER OBSERVATION.
   c. After five to ten minutes (depending on the size of the group), instruct these students to rotate to Liquid Station-2.

OUTCOMES 39 and 40 (Continued)

Procedures (Continued)

2. Liquid Station-2

   a. Instruct students to observe the water-filled balloon.
   b. Direct students to touch the balloon gently.
   c. Have students complete one handout STATE OF MATTER OBSERVATION.
   d. After five to ten minutes (depending on the size of the group), instruct these students to rotate to Solid Station-3.

3. Solid Station-3

   a. Instruct students to observe the solid ice shape.
   b. Encourage students to touch the solid ice formation.
   c. Have students take one gelatin dessert cup each and return to their desks.
   d. Ask them to remove the paper covering from the gelatin dessert and place it on the paper plate.
   e. Instruct students to complete one handout STATE OF MATTER OBSERVATION.
   f. Tell students to return to Solid Station-3 if additional observation of the ice formation is needed.
   g. Instruct students to rotate to all stations.
   h. Tell students that the gelatin dessert may be eaten after all stations have been observed.

4. Instruct students to rotate to all three stations and use the directions for visiting each station. Allow students to eat their gelatin dessert.

5. Discuss with students the handout STATE OF MATTER OBSERVATION.

   a. Help students understand how the liquids changed to solids.
   b. Help students realize that the gelatin dessert is a soft solid and ice is a hard solid.

STATE OF MATTER OBSERVATION
Handout

Name: _____ Station Number: _____ Date: _____

Place a ✓ in the blank before each statement that describes the state of matter at this station. Place an X in the blank before each statement that does not characterize the state of matter at this station.

_____ Takes the shape of its container.

_____ Has a definite size but not a definite shape.

_____ Has a definite size and shape.

_____ When poured into a container, spreads out until it has the same shape as the container.

_____ Has no definite size or shape.

_____ Oil, milk, alcohol, and gasoline are other examples of this state.

_____ Wood, iron, glass, rubber, wool, and butter are other examples of this state.

_____ Ammonia and carbon dioxide are other examples of this state.

Name this state of matter: _____

GRADE 3
PHYSICAL SCIENCE

UNIT: Matter and Energy
TOPIC: Properties and States of Matter
OUTCOME: 41. Identify solids, liquids, or gases in the environment.

Background

Matter is anything that occupies space and has weight.

Air, water, wood, stones, and metals are examples of matter. Humans, plants, animals, the sun, stars, and planets are also examples of matter.

Matter is found in four states: solids, liquids, gases, and plasma. Plasma is not discussed in this activity.

Materials

For each group:
- Balance scale

For each student:
- Ice
- Clear plastic cups (2)
- Cola
- Handout: MATTER

Procedures

1. Divide the class into groups of eight.
2. Distribute to each student the handout MATTER.
3. Instruct students to make a list of solids, liquids, and gases that they have observed in the environment.
4. Have students record the list on the handout MATTER, Part A.
5. Discuss Part A of the handout.
6. Distribute to each student one empty cup and one cup filled with cola and ice.
7. Direct each group to a balance scale.
8. Ask students to determine which cup weighs more by placing the cups on a balance scale.

OUTCOME 41 (Continued)

Procedures (Continued)

9. Through a discussion, emphasize that the matter inside the cup fills the space (cup) and has weight.

10. Ask students to complete Part B of the handout MATTER.

11. Discuss Part B of the handout with the students.

12. Tell students that all things in the universe can be classified as one or a combination of the four states of matter.

13. Instruct students to "drink the matter."

MATTER
Handout

Part A

Name: _____

SOLID	LIQUID	GAS
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Part B

1. Observe the carbonated beverage.

2. In the blanks below, list which part of the drink is a solid, which part is a liquid, and which part is a gas.

Solid _____

Liquid _____

Gas _____

GRADE 3
PHYSICAL SCIENCE

UNIT: Matter and Energy
TOPIC: Physical Changes and Conservation of Matter
OUTCOME: 42. Determine that a change of state or appearance is a physical change.

TOPIC: Conservation of Matter
OUTCOME: 46. Explore methods of conserving different forms of matter.

Background

The physical properties of a substance are those characteristics that can be readily observed with one or more of the five senses and do not cause the substance to be changed into another substance.

In a physical change, only the physical properties or characteristics of the substance are changed. It remains the same substance.

A physical change takes place when a substance changes in size or shape. Glass being broken, paper being torn, wood being chopped, and rocks being crushed are all examples of physical changes.

When a substance is heated and expands or is cooled and contracts, a physical change takes place.

A physical change also takes place when a substance changes its form or state, as when a solid is changed into a liquid or when a liquid is changed into a gas.

In most physical changes, the substance can be changed back to its original size, shape, or appearance.

This activity requires two days for completion.

Materials

- Erlenmeyer flask
- Water
- Freezer
- Jellied fuel
- Canned heat
- Sturdy balloon

For each student:
- Handout: MATTER OBSERVATION/PHYSICAL CHANGES

OUTCOMES 42 and 46 (Continued)

Procedures

Day One

Review with students the three states of matter. Ask students to give an example of each. Fill the flask three-fourths full with water. Ask students to name the state of matter inside the flask. On the outside of the flask, use a marker to indicate the level of the water. Place the flask in the freezer until day two.

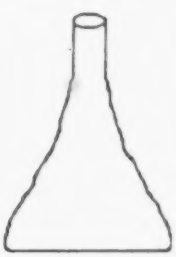
Day Two

1. Remove the flask from the freezer.
2. Ask students to recall the state of matter inside the flask on day one.
3. Ask students to name the state of matter inside the flask at the present time.
4. Distribute the handout MATTER OBSERVATION/PHYSICAL CHANGES.
5. Light the canned heat.
6. Place the burning canned heat in the stove.
7. Place the flask on the stove.
8. Attach a sturdy balloon over the mouth of the flask.
9. Ask students to make a pictorial record using the flask on the handout.
   a. Draw the water level on the flask.
   b. Record observations.
10. Ask students to predict the outcome of the experiment and record it on the handout.
11. Instruct students to continue to observe the experiment as the balloon expands. Have students record the various stages.
12. Discuss with students their predictions.
13. When the balloon bursts, cover the canned heat to extinguish the fire.
14. Ask students to list on the handout reasons why the balloon burst.
15. Make sure students are aware that the changing of states in this experiment is a physical change.

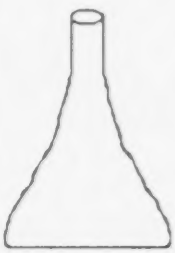
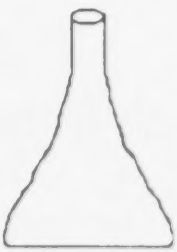
MATTER OBSERVATION/PHYSICAL CHANGES
Handout

Day 1 (before freezer) Day 2 (after freezer)

OBSERVATION:	OBSERVATION:	OBSERVATION:	OBSERVATION:
STATE OF MATTER:	STATE OF MATTER:	STATE OF MATTER:	STATE OF MATTER:

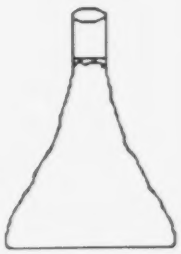
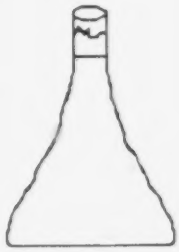
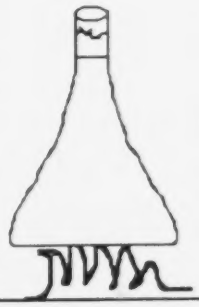
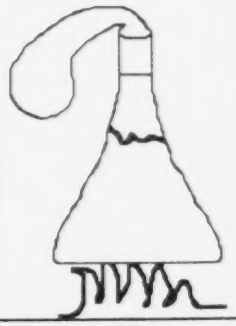
			
OBSERVATION:	OBSERVATION:	OBSERVATION:	OBSERVATION:
STATE OF MATTER:	STATE OF MATTER:	STATE OF MATTER:	STATE OF MATTER:

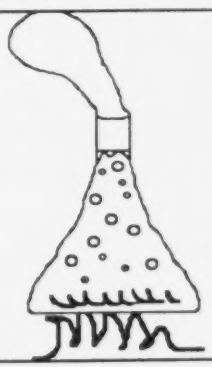
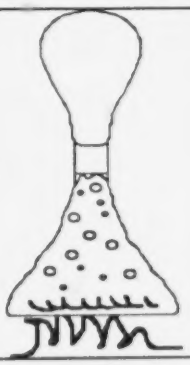
MATTER OBSERVATION/PHYSICAL CHANGES
Handout

			
OBSERVATION: STATE OF MATTER:	OBSERVATION: STATE OF MATTER:	OBSERVATION: STATE OF MATTER:	OBSERVATION: STATE OF MATTER:

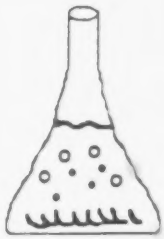
PREDICTIONS	REASONS

MATTER OBSERVATION/PHYSICAL CHANGES
Key

			
OBSERVATION: water **STATE OF MATTER:** liquid	**OBSERVATION:** frozen water water level - risen **STATE OF MATTER:** solid	**OBSERVATION:** frozen water (ice) add fire **STATE OF MATTER:** solid	**OBSERVATION:** ice melting add balloon **STATE OF MATTER:** solid and liquid

			
OBSERVATION: water **STATE OF MATTER:** liquid	**OBSERVATION:** water boiling **STATE OF MATTER:** liquid	**OBSERVATION:** water boiling balloon starts to fill up with gas **STATE OF MATTER:** liquid/gas	**OBSERVATION:** water boiling water level decreases balloon stands upright **STATE OF MATTER:** liquid/gas

MATTER OBSERVATION/PHYSICAL CHANGES
Key

			
OBSERVATION: water boiling balloon expanded **STATE OF MATTER:** liquid/gas	**OBSERVATION:** water boiling balloon burst too much gas inside balloon **STATE OF MATTER:** liquid/gas goes into air	**OBSERVATION:** water boiling water level down no heat **STATE OF MATTER:** liquid	**OBSERVATION:** water (not boiling) water level down **STATE OF MATTER:** liquid

PREDICTIONS	REASONS
1. ice will melt	1. heat turns ice to water
2. water will boil	2. balloon expands because gas takes up space
3. water turns to steam (gas)	3. too much gas for size of container
4. balloon will expand (with gas)	4. pressure causes balloon to burst, gas escapes
5. balloon will burst	

GRADE 3
PHYSICAL SCIENCE

UNIT: Matter and Energy
TOPIC: Effects of Temperature
OUTCOME: 43. Demonstrate how heat causes some matter to dissolve, melt, or evaporate.

Background

When a lump of sugar is added to a glass of water, the sugar gradually disappears. The molecules of the sugar spread out and move between the molecules of water. The sugar has dissolved in the liquid.

Solids usually dissolve better in hot liquids than in cold liquids. When heat is added to some solids, they become liquids, or they melt. The added heat energy makes the molecules in the solid vibrate more and more quickly until they spread apart and begin to flow as a liquid.

If enough heat is added to a liquid, it becomes a gas. The added heat makes the molecules move more quickly and stay farther apart than in the liquid state. When this condition occurs, the liquid evaporates and becomes a gas.

In this activity students will see how solids dissolve and melt more quickly with the addition of heat. They will also watch water evaporate as it boils.

Hot chocolate is prepared to demonstrate these properties. The activity is done with the total group; however, the preparation of the hot chocolate may be done in small groups with adult supervision. The quantities noted in the materials section are for 30 servings.

Materials

- Unsweetened chocolate squares (10 ounces)
- Water (5 cups)
- Sugar (1 1/4 cups)
- Salt
- Milk (15 cups)
- Non-stick sauce pans (3)
- Hot plate
- Spoons for stirring
- Glass beakers (2)
- Measuring cups

For each student:
- Paper cup, hot-cold

OUTCOME 43 (Continued)

Procedures

1. Tell students they are going to prepare a chocolate drink for their friends, but they do not have any way to heat the liquid or melt the chocolate.

2. Show students the Recipe: HOT CHOCOLATE.

3. Start preparation of the drink while students watch.

   a. Add sugar and salt to water. (It will dissolve very slowly.)
   b. Add mixture to chocolate squares in the sauce pan. (It will not melt.)
   c. Ask students if they think the sugar will ever dissolve or if the chocolate will melt.
   d. Tell students that since the sugar has not dissolved and the chocolate has not melted, they will need to set the mixture aside until it has dissolved or melted.

4. Ask students to use the recipe to calculate the amount of ingredients needed to make hot chocolate for the whole class.

5. Write the modified recipe on the chalkboard.

6. Prepare the hot chocolate as directed (see recipe).

   a. Be sure to point ou how quickly the sugar dissolved in the hot water.
   b. Refer to the cold mixture. Compare dissolving sugar in the cold water with dissolving sugar in the hot water.

7. Distribute the hot chocolate to each student for consumption.

8. Ask students to infer what happens to liquid if it is allowed to continue to boil.

9. Place a pan of water on the hot plate and allow it to "boil away."

10. Ask students to name the term that describe this process. (Evaporation)

HOT CHOCOLATE
Recipe

2 ounces unsweetened chocolate
1 cup water
1/4 cup sugar
dash of salt
3 cups milk

Heat water to a boil. Pour water into a glass container. Add sugar and salt. Stir until dissolved. Heat chocolate in a non-stick pan until melted. Add water and bring to a boil, stirring constantly until mixture is smooth. Reduce heat and simmer four minutes, stirring constantly. Stir in milk; cover and heat through but do not boil. 6 servings (2/3 cup)

GRADE 3
PHYSICAL SCIENCE

UNIT: Matter and Energy
TOPIC: Effects of Temperature
OUTCOME: 44. Predict effects of high temperature on various objects.

Background

There are several factors that affect the speed of evaporation. They are heat, surface area, wind, air pressure, temperature, and amount of water already in the air.

When heat is applied to a liquid, it makes the molecules move faster and father apart, allowing them to leave the liquid state (evaporate).

Evaporation takes place at all temperatures, but if a liquid is heated enough, gas bubbles form and rise to the top. When bubbles form in this way, liquid is said to boil. The temperature at which a liquid boils is called the boiling point. Each liquid has its own boiling point. Evaporation occurs rapidly at the boiling point.

In this activity students will examine the effects of heat on evaporation. The other variables (surface area, amount of water already in the air, wind, air pressure, and temperature) are held constant, since all containers are alike and the experiment takes place in the same room. This activity requires a week to complete. Begin the activity on a Monday so that students can make consecutive, daily observations for five days.

For safety precautions, the canned heat needs to be ignited each day and not left to burn through the night. Students in groups C and F will need close supervision as they observe the experiment.

Materials

For each group:
- Pyrex beakers, 500 mL (6)
- Water
- Powdered drink mix (2 packages)
- Sugar (1 /2 cups)
- Measuring cups
- Measuring spoons
- Canned heat stoves (2)
- Undisturbed area for placement of beakers at room temperature
- Undisturbed area near or on heating vent for placement of beakers.
- Masking tape
- Marker

168

OUTCOME 44 (Continued)

Materials (Continued)

For each student:
- Centimeter ruler
- Handout: EFFECTS OF TEMPERATURE
- Handout: PREDICTIONS

Procedures

Divide the class into six groups (A, B, C, D, E, and F). Have each group label its pyrex beaker with the assigned letter (A-F) using masking tape and a marker.

Day One

Part A. Preparation

1. Instruct groups A, B, and C to:

   a. Fill their beakers with 400 mililiters of water.
   b. Add one teaspoon of the powdered drink mix to the water (one package will be enough for two groups).
   c. Add 1/2 cup sugar to each water/drink mixture.
   d. Stir each mixture until dissolved.

2. Instruct groups D, E, and F to fill their beakers with 450 mililiters of water.

3. Instruct students to place beakers A and D side by side in an area where they will remain undisturbed for several days.

4. Instruct students to place beakers B and E side by side near or on a heating vent in the classroom.

5. Ignite both cans of canned heat and place the beakers from groups C and F to over the flames. (Be sure that students do not touch the beakers after this point.) Remind students to observe any changes by the end of each day. (The canned heat will have to be ignited each morning.) NOTE: Explain to students that in a laboratory situation the heat source would not be extinguished overnight.

6. Instruct students to return to their seats for a group discussion.

Part B. Discussion and Observation

1. Engage students in a class discussion about the evaporation process. Use the handout PREDICTIONS.

2. Distribute the handout EFFECTS OF TEMPERATURE to each student.

OUTCOME 44 (Continued)

Procedures (Continued)

3. Discuss procedures for completing the handout.

4. Explain to students that the experiment will take one week.

5. Instruct students to return to their assigned stations where their beakers are located.

6. Instruct students to complete the Day 1 section of the handout for their stations.

   a. Record the amount of liquid in mililiters.
   b. Note zeros have been placed in the spaces for predicted amount of liquid loss and actual loss, since this is the first day.
   c. Predict the amount of liquid that will evaporate from the beaker in 24 hours. Record this prediction in the appropriate box for the next day.

7. After five to ten minutes, instruct students to rotate and complete the first requirement for the next station. Make sure students include predicted liquid loss for day two.

8. Continue to have students rotate until all beakers have been observed and all beginning water levels have been recorded on the handout.

9. Tell students they will be recording daily the water levels in the beakers. They will also predict the liquid loss that will occur daily.

Days Two through Four (or until liquids have evaporated significantly enough to show a pattern.)

During this period of time, have students monitor the evaporation process in an informal setting. Let students make observations at the same time daily, then record the information on the handout EFFECTS OF TEMPERATURE.

Initiate a follow-up discussion using the handout PREDICTIONS. Have students compare their predictions with the recorded observations from the handout.

Extensions

- Have students graph the information recorded on the handout.

- Have students add another variable (salt water) and compare it to the plain water and soft drink mix to see if evaporation occurs at a different rate.

EFFECTS OF TEMPERATURE
Handout

DIRECTIONS:

Name _____

① Record the volume of the liquid in each beaker (milliliters).

② Record the height of the liquid by placing a centimeter ruler at the bottom of the container. Write in the appropriate box of the CHART the number that is even with the water level.

③ Predict the amount of liquid loss that you think will occur in each beaker by the next day.

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
A	450 mL ①	mL	mL	mL	mL
Water level	cm ②	cm	cm	cm	cm
Predicted amount of loss	③ __ cm	__ cm	__ cm	__ cm	__ cm
Actual amount of loss	__ cm ④	__ cm	__ cm	__ cm	__ cm
B	mL	mL	mL	mL	mL
Water level	cm	cm	cm	cm	cm
Predicted amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm
Actual amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm
C	mL	mL	mL	mL	mL
Water level	cm	cm	cm	cm	cm
Predicted amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm
Actual amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm

After a 24 hour period:

4. Measure the amount of actual water loss, using the method described in #2.

5. Predict the amount of liquid loss by the next 24 hour period.

6. Repeat every 24 hours.

EFFECTS OF TEMPERATURE
Handout

Name _____

DIRECTIONS:

① Record the volume of the liquid in each beaker (milliliters).

② Record the height of the liquid by placing a centimeter ruler at the bottom of the container. Write in the appropriate box of the CHART the number that is even with the water level.

③ Predict the amount of liquid loss that you think will occur in each beaker by the next day.

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
D	450 mL ①	mL	mL	mL	mL
Water level	cm ②	cm	cm	cm	cm
Predicted amount of loss	③ __ cm	__ cm	__ cm	__ cm	__ cm
Actual amount of loss	__ cm ④	__ cm	__ cm	__ cm	__ cm
E	mL	mL	mL	mL	mL
Water level	cm	cm	cm	cm	cm
Predicted amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm
Actual amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm
F	mL	mL	mL	mL	mL
Water level	cm	cm	cm	cm	cm
Predicted amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm
Actual amount of loss	__ cm	__ cm	__ cm	__ cm	__ cm

After a 24 hour period:

4. Measure the amount of actual water loss, using the method described in #2.

5. Predict the amount of liquid loss by the next 24 hour period.

6. Repeat every 24 hours.

PREDICTIONS
Handout

1. What is evaporation?

2. Will evaporation occur in all of the beakers?

3. Will evaporation occur evenly in all of the beakers?

4. From which beaker will the liquid evaporate more quickly?

5. How long will it take for each beaker to evaporate completely?

A _____ D _____

B _____ E _____

C _____ F _____

6. Will the water evaporate at the same rate as the water/drink mixture? Why or why not?

PREDICTIONS
Key

1. What is evaporation?

   Evaporation is the process by which a liquid changes to a gas. In order for evaporation to occur, the liquid molecules must be exposed to an energy source that causes the liquid molecules to move more quickly and spread farther apart, thus forming a gas.

2. Will evaporation occur in all of the beakers? (Yes)

3. Will evaporation occur evenly in all of the beakers? (No)

4. From which beaker will the liquid evaporate more quickly? (Beakers C & F)

5. How long will it take for each beaker to evaporate completely?

   A _____ D _____

   B _____ E _____

   C _____ F _____

6. Will the water evaporate at the same rate as the water/drink mixture? Why or why not?

GRADE 3
PHYSICAL SCIENCE

UNIT: Matter and Energy
TOPIC: Chemical Changes
OUTCOME: 45. Demonstrate simple chemical changes.

Background

In a chemical change, the chemical properties or characteristics of a substance are changed so that a new substance with properties that are different from the original substance is formed. For a chemical change to take place, energy (such as heat, light, or electricity) is either given off or needed.

Some examples of a chemical change are when vinegar acts on baking soda to produce bubbles of carbon dioxide gas, when moisture acts on iron to produce rust, when wood burns, when milk sours, when food digests, and when silver tarnishes.

In this activity the students will observe two different chemical changes. The activity will take a portion of two days to complete.

Materials

- Measuring cup (1/4)
- New pennies (10)

For each student:
- Paper cups (5-ounce)
- Well-tarnished pennies (2-3)
- White vinegar (1/4 cup)
- Ginger ale (1/4 cup)
- Raisins (4)

Procedures

Day One

1. Distribute the following to each student:

    a. Vinegar in a paper cup (approximately 1/4 cup)
    b. Tarnished pennies (2-3)
    c. Ginger ale in a paper cup (approximately 1/4 cup)
    d. Raisins (4)

2. Pass new pennies around the classroom for observation.

3. Instruct students to place the tarnished pennies in the vinegar. Set the vinegar and pennies aside until Day Two.

4. Ask students to place the raisins in the ginger ale one at a time.

OUTCOME 45 (Continued)

Procedures (Continued)

5. Describe the change that takes place.

6. Ask students to give other examples of chemical changes they have seen that may be similar to what took place with the raisins.

Day Two

1. Instruct students to do the following:

   a. Observe the pennies in the vinegar.
   b. Remove the pennies from the vinegar.
   c. Notice the color change in the vinegar.
   d. See if the pennies have changed color.

2. Ask students to explain what happened to the pennies and the vinegar.

3. Explain to students that vinegar is a weak acid and it chemically removed the tarnish from the pennies.

GRADE 3
PHYSICAL SCIENCE

UNIT: Matter and Energy
TOPIC: Conservation of Matter
OUTCOME: 46. Explore methods of conserving different forms of matter.

Background

In many chemical changes, such as when hydrogen gas combines with oxygen gas to form water, it appears as if a new matter has been created. In other chemical changes, such as when a candle burns, it seems as if matter has disappeared or has been destroyed.

The law of conservation of matter states that in an ordinary chemical change, matter is neither created nor destroyed, but only changes from one form to another.

The water cycle is a good example of conservation of matter. Water evaporates, turns into a gas, goes into the atmosphere, condenses, and returns to the earth's surface as rain.

In this activity students can observe a mini water cycle in the classroom. The activity is a teacher demonstration.

Materials

- Saucepan
- Frying pan, same diameter as saucepan
- Hot plate
- Ice
- Water

Procedures

1. Review with students the three states of matter.

2. Ask students to identify water as a liquid.

3. Instruct students to observe while these steps are demonstrated.

    a. Fill the saucepan half full with water.
    b. Place the saucepan on the hot plate.
    c. Heat to a boil.
    d. Place ice in the frying pan.
    e. Hold the pan four inches above the boiling water.
    f. Continue to hold the pan until water droplets form on the bottom of the frying pan (caused by the condensation of the water vapor from the saucepan) and drip back into the saucepan.

OUTCOME 46 (Continued)

Procedures (Continued)

4. Help students realize that the evaporation of the water in the saucepan does not mean the liquid matter has gone away. It has only changed states.

GRADE 3
PHYSICAL SCIENCE

UNIT: Sound
TOPIC: Production of Sound
OUTCOME: 47. Identify and classify ways of producing sound.

TOPIC: Vibration of Sound
OUTCOME: 48. Listen and distinguish among soft, high, and low sounds.

Background

All sound is caused by waves. Sounds are made by vibrating objects. Sounds vary generally in two ways, amplitude and pitch. The amplitude (volume or loudness) of sound is an indication of how much energy was used to produce it. The longer the amplitude of a sounding body, the louder the sound. Pitch is determined by the rapidity that an object vibrates. The faster an object vibrates, the higher the pitch.

Sound is very important to our daily lives. Sound makes it possible for us to communicate with others. It also provides information and entertainment.

Materials

- Balloons
- Small cans with one end removed
- Pencils

For each student:
- Handout: SOUND OBSERVATION

Procedures

1. Divide the class into four groups.

2. Assign each group to a station.

3. Tell the students to follow the directions at each station.

   NOTE: Allow students 7-10 minutes at each station

4. Discuss what took place at each station after groups have visited all four stations.

Station I

1. Take a balloon.

2. Blow air into the balloon.

3. Listen to the sound the air makes as it passes into the balloon.

OUTCOMES 47 and 48 (Continued)

Procedures (Continued)

4. Complete appropriate spaces on the handout SOUND OBSERVATION.

5. Take the inflated balloon to Station II.

Station II

1. Use the inflated balloon from Station I.

2. Pop the balloon.

3. Listen to the sound that is produced when the balloon is popped.

4. Complete appropriate spaces on the handout SOUND OBSERVATION.

NOTE: Students starting at this station will not have an inflated balloon from Station I. They will have to inflate a balloon at Station II.

Station III

1. Take a small can with one end removed and a sheet of rubber membrane from a balloon.

2. Stretch the balloon membrane tightly over the open end of the can.

3. Secure the balloon membrane with tape.

4. Tap on the balloon membrane with a pencil.

5. Listen to the sound a pencil makes as it touches the balloon membrane.

6. Complete appropriate spaces on the handout SOUND OBSERVATION.

Station IV

1. Take a balloon and inflate it.

2. Stretch the opening of the balloon tightly and let the air out slowly.

3. Listen to the sound the air makes as it passes through the opening.

4. Complete appropriate spaces on the handout SOUND OBSERVATION.

SOUND OBSERVATION
Handout

Name: _____

Station #	Way Sound is Produced	Soft, Loud, High, or Low
Station I		
Station II		
Station III		
Station IV		

GRADE 3
PHYSICAL SCIENCE

UNIT: Sound
TOPIC: Sound Transmitters
OUTCOME: 49. Determine what forms of matter transmit sound best.

Background

Sound is a form of energy that is caused when an object moves back and forth or vibrates rapidly. When the vibrations stop, the sound stops.

Sounds travel through solids, liquids, and gases. Most sounds reach the human ear through gases. The heavier the gas, where the molecules are close together, the better and faster sound travels.

Sound travels better through liquids than it does through gases. In liquids, the molecules are closer together than the molecules in gases, so the sound vibrations are carried more easily and faster.

Sound travels faster and better through solids than through liquids or gases. In solids, the molecules are very close together and carry the vibrations very easily and quickly.

In this activity students will work in pairs to listen to the sound produced when two rocks are hit together and the sound is transmitted through three different mediums. Unless a water source is available for each pair, students will need to work in groups of approximately six to share the aquarium or sink.

The handouts LABORATORY CARD and QUESTIONS FOR DISCUSSION need to be placed on 5"X 8" index cards. One laboratory card and one question card are needed for each pair of students.

Materials

For each pair:
- Rocks (2)
- Solid desk or table
- Handout: LABORATORY CARD
- Handout: QUESTIONS FOR DISCUSSION

For each group:
- Aquarium, sink, or large pans filled with water

Procedures

1. Fill the aquarium, sink, or large pans with water. If large pans are used, place them at different locations in the room.

OUTCOME 49 (Continued)

Procedures (Continued)

2. Divide students into pairs.

3. Place the pairs into groups of approximately six students.

4. Assign each group to a water source.

5. Distribute the following materials to each pair:

   a. Two rocks
   b. Handout: LABORATORY CARD
   c. Handout: QUESTIONS FOR DISCUSSION

6. Ask students to follow the directions on the handout LABORATORY CARD. Explain that in step B, the water source must be shared.

7. After the students complete the handout LABORATORY CARD, direct all students to complete the handout QUESTIONS FOR DISCUSSION on their own paper.

8. Discuss the results with the class.

LABORATORY CARD
Handout

Instructions

A. Transmission of Sound Through Air (a gas)

1. Stand with your desk or a table between you and your partner.

2. Hit two rocks together.

3. Ask your partner to describe the sound.

B. Transmission of Sound Through Water (a liquid)

1. Stand at one end of the water container with your partner at the opposite end.

2. Hit the two rocks together underneath the water while your partner holds his or her ear close to the water on the opposite end.

3. Ask your partner to describe the sound.

4. Ask your partner to identify which sound was louder, the one in air or water.

C. Transmission of Sound Through a Desk (a solid)

1. Stand with your desk or a table between you and your partner.

2. Hit one rock on top of the desk and the other rock underneath the desk while your partner listens for the sound with his or her ear near the opposite end of the desk.

3. Ask your partner to describe the sound.

4. Ask your partner which sound was louder and clearer. Was it the one transmitted through air, through water, or through the desk?

D. Have your partner repeat the steps while you listen.

QUESTIONS FOR DISCUSSION
Handout

1. Which sound was the loudest?
2. Why was it the loudest?
3. What is producing the vibrations in each of the mediums?

   Gas -

   Liquid -

   Solid -

GRADE 3
CONTRIBUTIONS AND CAREERS IN THE FIELDS OF LIFE SCIENCE, EARTH SCIENCE, AND PHYSICAL SCIENCE

UNIT: Contributions and Careers in Science
TOPIC: Contributions of Scientists

OUTCOMES:
50. Identify men and women who have contributed to the fields of Life Science, Earth Science, and Physical Science.

51. Describe what men and women have done in the fields of Life Science, Earth Science, and Physical Science.

52. Explain why an understanding of Life Sciences, Earth Sciences, and Physical Sciences can contribute to the quality of life in today's and tomorrow's society.

TOPIC: Career Opportunities

53. Identify careers related to an understanding of Life Sciences, Earth Sciences, and Physical Sciences.

54. Explain how careers depend on a basic understanding of Life Sciences, Earth Sciences, and Physical Sciences.

Background

The goal of science education should be to develop scientific literacy through a balanced science curriculum that prepares students to 1) pursue further studies in science and technology, 2) participate in a technological society of informed citizens, 3) enter the modern work world, and 4) develop intellectually and morally to their fullest. ("The New Basic in Education: Sciencing" taken from an interview given by Dr. Gerald Krockover, Professor of Geosciences and Education, Purdue University.)

Building more realistic images of scientists may help students become interested in science as career choices. The stereotypical image of a scientist as a man in a white lab coat must be broadened. A scientist may be a parent, a neighbor, or a teacher. In short, a scientist is anyone who studies a problem using the scientific method of research in gathering data, conducting experiments, making observations, and testing results.

Biographical data on scientists included in this section of the curriculum guide may be helpful with activities that address contributions and careers in the fields of Life Science, Earth Science, and Physical Science.

OUTCOMES 50, 51 52, 53 and 54 (Continued)

Background (Continued)

Biographical data may be expanded to include many other scientists. The information about each scientist may be stored in a biographical data file. The following procedures describe how to construct a biographical data file.

Materials

- Shoe box
- Adhesive-backed paper
- Index cards, 5" x 8"
- Tabs or markers
- Biographical Data: ANTOINE LAURET LAVOISIER
- Biographical Data: MARY LEAKEY
- Biographical Data: JOHN MILNE
- Biographical Data: CHARLES RICHTER

Procedures

Make a biographical data file on famous scientists. Transfer the biographical data of Antoine Lauret Lavoisier, Mary Leakey, John Milne, and Charles Richter onto 5- by 8-inch index cards. Separate the index cards into three categories: Life Sciences, Earth Sciences, and Physical Sciences. Use tabs to indicate category separations or used markers to color-code corners of the index cards (Life Sciences--red, Earth Sciences--blue, Physical Sciences--green). Cover a shoe box with colorful adhesive-backed paper. Use the shoe box as a container for the biographical data cards. Use the biographical data file with each activity concerning contributions and careers of scientists.

Antoine Laurent Lavoisier (1743-1794)
Biographical Data

Although Robert Boyle, 1627-1692, is called the father of chemistry, Antoine Laurent Lavoisier, a frenchman, more fully deserves to be called the father of modern chemistry.

After many careful experiments with fire, Lavoisier was the first to give a scientific explanation of this mystery. Lavoisier performed a series of experiments with tin. In his simplest experiment, he placed a quantity of tin in a flask and sealed it. He weighed the flask, then heated it strongly until the tin changed into a powder. He weighed the flask again and found no change. He then carefully removed the seal and observed that air rushed in. He resealed the flask and weighed it again. He found the flask had increased in weight. He concluded that the change in weight was due to the weight of air that had rushed in when the seal was first broken. He realized that during combustion, something in the atmosphere had been removed to combine with the tin. At this time, he did not know what had been removed. After many more experiments and the examination of the work of John Priestly of England, who at this time was experimenting with various types of "airs," Lavoisier defined the burning process as a chemical reaction in which various kinds of matter combine with what he named oxygen.

Lavoisier also proved the law of conservation of matter. He showed that the total weight of all the reaction products is equal to the total weight of all the reactants from which the reaction products were formed--there is no loss of mass during chemical change. Matter can be neither created nor destroyed. It can only change forms. He helped establish the metric system, and explained that any chemical action could be expressed by an equation. For his investments in a tax collecting firm, he was guillotined during the French Revolution.

Mary Douglas Leakey (1913-)
Biographical Data

Mary Douglas Leakey (1913-) has worked chiefly in Keyna and Tanzania. In 1948, she found the skull of a creature that lived about 20 million years ago in Kenya. This creature, named Proconsul africanus, is regarded by some scientists as close to the common ancestor of human beings and apes. In 1959, Mary Leakey found the skull of a humanlike creature at Olduvai Gorge. This creature, named Zinjanthropus, is thought to have lived about 1,750,000 years ago. This discovery was one of the first indications that humanlike creatures once lived in eastern Africa.

In 1978, a team led by Mary Leakey found a trail of footprints preserved in volcanic ash at Laetoli, Tanzania. Most scientists believe these fossils belonged to a humanlike creature who lived about 3,700,000 years ago. The specimens are among the oldest known fossils of a humanlike ancestor.

Mary Leakey was born in London. Her books include Africa's Vanishing Art: The Rock Paintings of Tanzania (1983) and an autobiography, Disclosing the Past (1984).

John Milne (1850-1913)
Biographical Data

In the late 1800s John Milne and a group of British scientists working in Japan invented a machine to detect and record earthquakes. Milne's invention was called the seismograph. He later returned to Great Britain where he established the field of Seismology, the study of earthquakes.

Charles Richter (1900-)
Biographical Data

An American seismologist, Charles Richter, developed a system of measuring earthquakes in 1935. This system is called the Richter Scale. It is a number that indicates the strength of an earthquake. Magnitude is calculated by using information obtained from a seismograph.

OUTCOMES 50, 51, 52, 53, and 54 (Continued)

Background

It is necessary to become familiar with the biographical information provided for Antoine Lauret Lavoisier before the start of this activity.

In this activity students will see how oxygen is "used up" in the burning process. In small groups students will need to use matches to light candles. Assistance may be necessary when students are working with fire.

Materials

- Biographical Data: Antoine Laurent Lavoisier

For each group:
- Candles, two-inch (4)
- Pyrex beakers, (without a pour spout) or jars in graduated sizes (4)
- Kitchen matches
- Stopwatch or digital watch
- Notebook or paper
- Graph paper

Procedures

1. Divide the class into four groups.

2. Instruct each group to do the following:

   a. Arrange the beakers with candles under them, from largest to smallest.
   b. Observe the difference in the size of the beakers.
   c. Remove the beakers from the candles.

3. Assist the students in lighting the candles.

4. Instruct the students to place the beakers over the candles simultaneously.

5. Ask students to predict what they think will happen and why.

6. Instruct students to use the stop watch to note the amount of time elapsed when the candle burns out and record it in their notebooks.

OUTCOME 50, 51, 52, 53, and 54 (Continued)

Procedures (Continued)

7. Help students prepare a graph of their data.

8. Discuss the data.

9. Introduce the term "oxygen."

10. Discuss the biographical information on Lavoisier.

Background

"A fossil is the remains of a plant or animal, or some indication of the former presence of these remains, buried and preserved in rocks of the earths crust by natural causes."

Molds, casts, imprints, tracks, trails, and burrows all show the existence of former life. They are the most common among rocks formed from soft sediments into which an impression was made.

In the following activity students will make fossil footprints in mud to represent those found by Mary Leakey at Laetoli, Tanzania in 1978.

Students need to be instructed to wear or bring old clothing for this activity. The activity should be conducted outside if at all possible. If conducted in the classroom, plastic will need to be placed on the floor to protect it from the mud.

It will be necessary to discuss the biographical information on Mary Leakey prior to this activity.

Materials

- Biographical Data: Mary Leakey
- Soil
- Water in buckets or a water hose
- Tub (large enough to hold enough soil to fill a shoe box for each student in the class)
- Utensils for stirring mud
- Plastic to cover the floor (if activity is done inside)

For each student:
- Shoe box lined with foil
- Paper towel

OUTCOME 50, 51, 52, 53, and 54 (Continued)

Procedures

1. Choose an outdoor area to set up the activity.

2. Choose five students to mix mud.

3. Instruct the "Mud Mixers" to follow these steps.

   a. Place the soil in the large tub.
   b. Add enough water to make a thick paste.
   c. Mix muds with hands or stirring utensil.

4. Instruct the other students to follow these steps.

   a. Write their names on their shoe boxes.
   b. Fill their shoe boxes 2/3 full of mud.
   c. Remove shoes and socks.
   d. Place one foot in the mud to make an impression.
   e. Remove the foot, leaving an imprint.
   f. Wash muddy feet and hands with water and dry with paper towels.

5. Have students return to the classroom and place the boxes in an undisturbed area to dry.

6. After the fossils have dried (one or two days), have students remove them from the shoe boxes for observation.

7. Have students arrange the footprints in a trail to represent the trail found by Mary Leakey.

Background

Medicine is the science and art of healing. Medicine is a science because it is based on knowledge gained through careful study and experimentation. It is an art because it depends on how well doctors and other medical workers apply this knowledge to help people. Medicine seeks to save lives and relieve suffering; thus, it has long been a respected profession. Doctors are specially trained in the diagnosis, treatment, and prevention of diseases.

Some doctors provide medical care while others serve as medical researchers, teachers of medicine, or administrators of medical institutions. Doctors can be classified into two main groups: general practitioners and specialists.

OUTCOME 50, 51, 52, 53, and 54 (Continued)

Background (Continued)

General practitioners, commonly known as family physicians, treat the more common disease processes. When necessary, general practitioners refer their patients to specialists who are more familiar with specific medical problems. Some individuals consult with a specialist without ever seeking the advice of a family physician.

Men and women who choose medicine as a career need compassion, drive, and a great desire to learn.

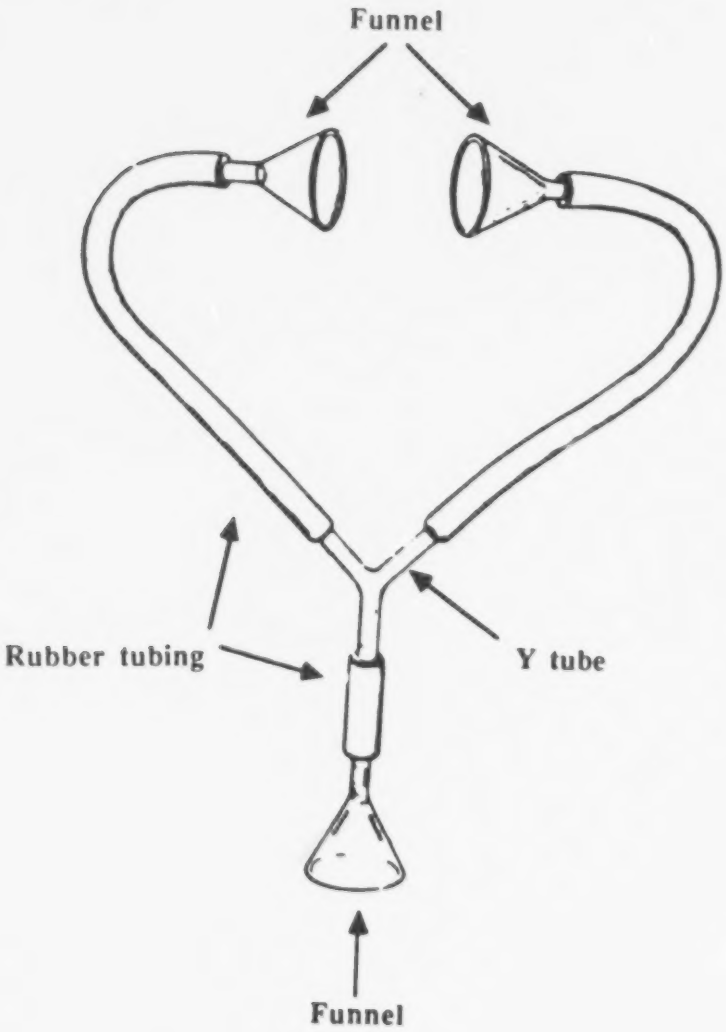
Materials

For each pair:
- Rubber or plastic tubing, 30 cm long (2), 10 cm long (1)
- Funnels (3)
- Glass Y or T tube
- Handout: HOMEMADE STETHOSCOPY DIAGRAM
- Handout: DIRECTIONS FOR THE DOCTOR
- Handout: HEART RATE CHART

Procedures

1. Pair students.
2. Distribute materials to each pair.
3. Have each pair assemble a stethoscope according to the diagram.
4. Let students take turns listening to each other's heart beats (for practice).
5. Have students role-play doctor and patient by following the directions on the handout DIRECTIONS FOR THE DOCTOR.
6. Tell students to exchange roles and repeat the process.
7. Have students compare their data to those of fellow students.
8. Students may wish to graph the information.

HOMEMADE STETHOSCOPE DIAGRAM
Handout



DIRECTIONS FOR THE DOCTOR
Handout

1. Place the stethoscope on the left side of your patient's chest (on the heart).

2. Count the number of heart beats in one minute.

3. Record the data under "resting rate" on the patient's chart.

4. Instruct your patient to exercise for three minutes.

5. Record your patient's heart rate immediately after exercise.

6. Wait three minutes (recovery time), then check your patient's heart rate.

HEART RATE CHART
Handout

Patient _____ Patient _____

Age _____ Age _____

Heart rate - number of beats per minute		
resting rate	after exercise	recovery rate

Heart rate - number of beats per minute		
resting rate	after exercise	recovery rate

OUTCOME 50, 51, 52, 53, and 54 (Continued)

Background

It is necessary to become familiar with the biographical information provided before beginning this activity.

An earthquake is a natural phenomenon. Earthquakes are caused by the constant motion of the earth's surface. The motion creates buildup and releases of energy stored in rocks at or near the earth's surface. Earthquakes are the sudden, rapid shaking of the earth as this energy is released.

One way to describe an earthquake is in terms of the amount of energy it releases. That energy is indicated by the strength of the surface and body waves that travel out from the earthquake's origin. In the late 1800s a group of British scientists working in Japan developed a machine called a seismograph. John Milne invented the most famous of these early seismographs. Milne, who returned to Great Britain, established the field of seismology, which is the study of earthquakes.

Charles F. Richter, an American seismolgist, developed a system of measuring earthquakes in 1935. The system is called the Richter Scale.

The directions for constructing the seismograph, LAB CARD, DIAGRAM I, and DIAGRAM II, need to be reproduced and placed on index cards prior to this activity.

Materials

- Biographical Data: John Milne and Charles Richter

For each group:
- Heavy books (5-7)
- Rubber bands, 10 cm long (3-5)
- Felt tip pen, fine line
- Wooden centimeter rulers (2)
- Modeling clay
- Steel washer
- Paper on a roll, at least 20 cm wide
- Index cards
- Scissors
- SEISMOGRAPH DIAGRAM I
- SEISMOGRAPH DIAGRAM II
- RICHTER SCALE
- LAB CARD (Directions for seismograph)

Procedures

1. Discuss biographical information with students.

2. Divide students into groups of four.

OUTCOME 50, 51, 52, 53, and 54 (Continued)

Procedures (Continued)

3 Distribute materials to each group.

4. Instruct groups to construct their seismographs according to the handouts LAB CARD and SEISMOGRAPH DIAGRAMS I AND II.

5. After groups have completed the construction of their seismographs, mock "earthquakes" can be produced by instructing the groups to do the following:

   a. Sit in pairs at opposite ends of the table or desk where the seismograph is located.
   b. The first student holds the roll of paper.
   c. The second student holds the free end of the paper.
   d. The remaining two students shake the table gently.
   e. As the table is being shaken, the second student pulls the paper forward recording the "earthquake" data.

6. Instruct students to refer to the DIAGRAM II to measure the magnitude of the "earthquake."

7. Instruct students to repeat the "earthquake" process three times, each time shaking the table a little harder to increase the magnitude.

8. Instruct students to refer to the RICHTER SCALE and complete these steps.

   a. Find the largest number on the scale.
   b. Compare the largest magnitude of the "earthquake" to the scale.

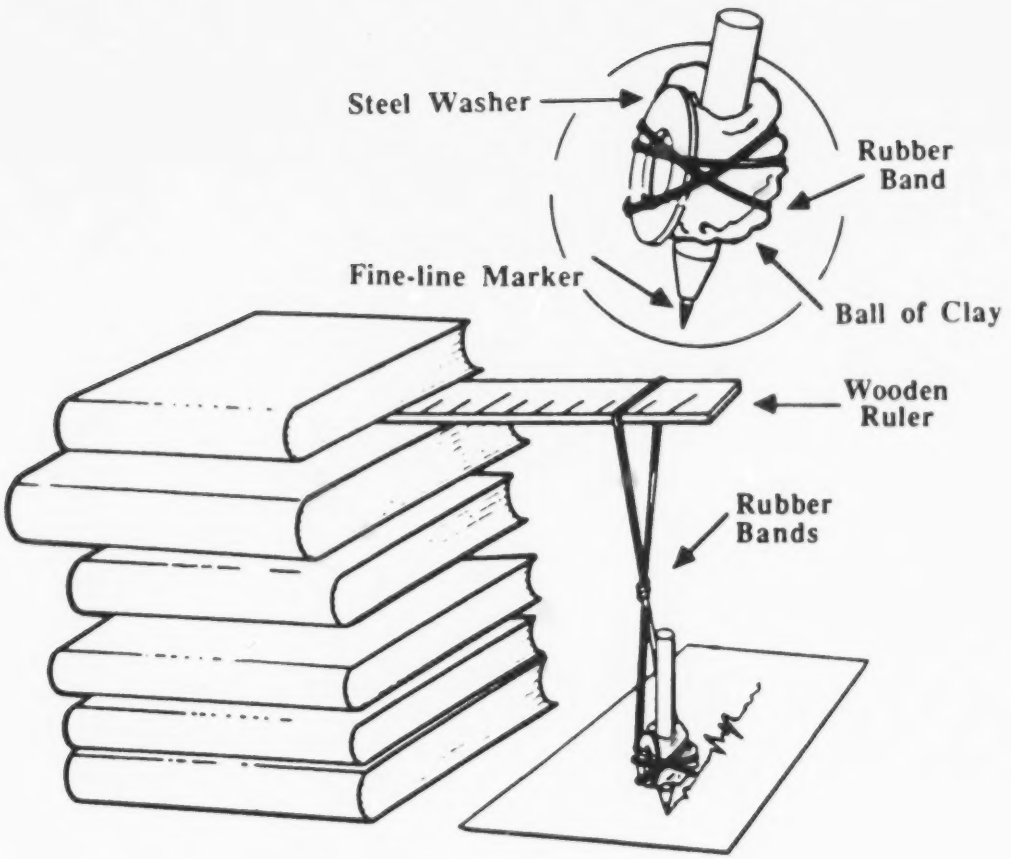
9. Ask students to guess where they think their earthquakes would fit on the scale.

LAB CARD
Handout

(Directions for construction of the seismograph)

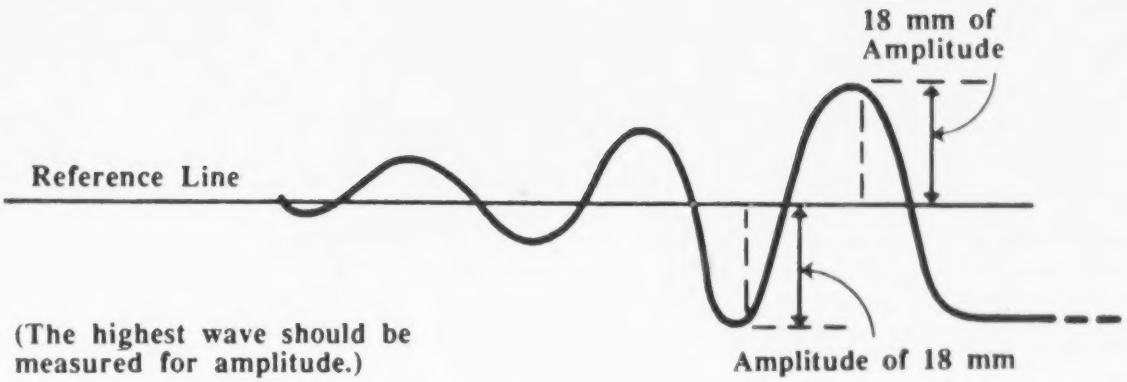
1. Refer to DIAGRAM I to aid in construction of the seismograph.
2. Tie two rubber bands together (long ends).
3. Attach one end of the rubber band to the washer.
4. Remove the cap from the felt tip pen.
5. Use the clay to attach the washer to the pen.
6. Secure the washer with an additional rubber band.
7. Stack the books.
8. Place the ruler between the top book and the one below it.
9. Place the free end of the rubber band around the ruler.
10. Remove or add books as needed so the tip of the pen just touches the surface of the paper.
11. Place the paper under the pen.
12. Your Seismograph is now ready to be use.

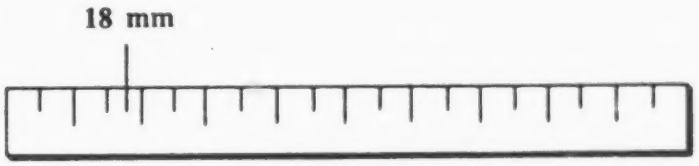
SEISMOGRAPH DIAGRAM I
Handout



202

SEISMOGRAPH DIAGRAM II
Handout





Metric Ruler

1. Use a ruler to draw a reference line down the middle of your paper.
2. Find the largest amplitude.
3. Use your ruler to measure the amplitude of the wave.

RICHTER SCALE
Handout

Richter Magnitude	TNT Energy Equivalent	Example (approximate)
1.0	6 ounces	Small Blast at a Construction Site
1.5	2 pounds	
2.0	13 pounds	
2.5	63 pounds	
3.0	397 pounds	
3.5	1,000 pounds	
4.0	6 tons	Small Atomic Bomb
4.5	32 tons	Average Tornado
5.0	199 tons	
5.5	500 tons	Messena, NY Quake, 1944
6.0	6,270 tons	
6.5	31,550 tons	Coalinga, CA Quake, 1983
7.0	199,000 tons	Hebgen Lake, MT Quake, 1959
7.5	1,000,000 tons	
8.0	6,270,000 tons	San Francisco, CA Quake, 1906
8.5	31,550,000 tons	Anchorage, AK Quake, 1964
9.0	199,999,000 tons	